THE HAWAIIAN PLANTERS' MONTHLY

PUBLISHED FOR THE

HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Vol. XXII.] HONOLULU, NOV. 16, 1903. [No. 11

MEETING NOTICE.

The annual meeting of Hawaiian Sugar Planters' Association will be held at the rooms of the Association in the Judd Building, Honolulu, on Monday, November 23, 1903.

PLANTERS' ASSOCIATION COMMITTEES.

A report is expected at the annual meeting of the Association from each committee, and the members thereof are requested to confer together in order that the reports may be as interesting as possible and embody the ideas of all the members of each committee:

The following is a list of the committees:

LABOR—W. M. Giffard, Chairman; E. D. Tenney, E. F. Bishop, J. P. Cooke, E. E. Paxton.

CULTIVATION—Geo. F. Renton, Chairman; H. Deacon, W. A. Baldwin, D. Forbes, L. Barkhausen, H. P. Faye.

FERTILIZATION—C. F. Eckart, Chairman; Fred Meyer, C. B. Wells, J. T. Chawley, J. F. C. Hagens, C. McLennan.

IRRIGATION—H. P. Baldwin, Chairman; W. W. Goodale, L. Barkhausen, J. A. Low, Geo. C. Hewitt.

HANDLING AND TRANSPORTATION OF CANE—C. C. Kennedy, Chairman; A. Horner, F. B. McStocker, John Sherman, H. A. Baldwin, F. Weber.

MANUFACTURE—John A. Scott, Chairman; E. E. Olding, Wm. Pullar, Andrew Adams, A. Moore, H. P. Baldwin.

MACHINERY—W. Stodart, Chairman; C. Hedemann, J. A. Low, Jas. Scott, J. T. Moir, Geo. Ross.

UTILIZATION OF BY-PRODUCTS—W. W. Goodale, Chairman; Jas. Gibb, Jas. Renton, W. G. Walker, Andrew Adams, G. H. Fairchild.

DISEASES OF CANE—R. C. L. Perkins, Chairman; A. Lidgate, D. C. Lindsay, K. S. Gjerdrum, G. F. Renton, A. Ahrens.

FORESTRY—L. A. Thurston, Chairman; H. A. Baldwin, G. N. Wilcox, T. S. Kay, G. C. Chalmers.

EXPERIMENT STATION—F. M. Swanzy, Chairman; F. A. Schaefer, H. A. Isenberg, G. H. Robertson, J. P. Cooke.

FORESTRY DEVELOPMENT.

The rapidity with which the subject of forestry has come into prominence, both in the United States at large and in this Territory in particular, indicates that the "prophets" who have been so long "crying in the wilderness" have at last secured the attention of practical business men as well as of theoretical forestry enthusiasts.

A local demonstration of this fact is that the present forestry law was drawn by a committee of the Sugar Planters' Association and was passed by the legislature very largely through the efforts of planters and ranchmen, both in and out of that body.

There is very little sentiment or poetry in the average Hawaiian ranch or plantation manager. His standpoint is purely the business one—the most income for the least outgo. There is great significance therefore in the fact that from every part of the Territory the leading plantation and ranch managers have accepted the positions of volunteer foresters under the Board of Forestry.

The only interpretation of this action is that the practical business men of the Territory have become convinced that the preservation of existing forests, and the reforesting of denuded areas is a business necessity. The result will be that in each district the forestry board will have the active support of the practical men, in the carrying out of their policy.

The recent visit of W. L. Hall, the Chief of the Division of Forestry Extension will have a tendency to put the local Forestry Board in close connection with the National Forestry Department, and give it the benefit of advice and material assistance from that quarter.

The local Board has announced the policy of first securing the establishment of forest reservation lines, and later of reforesting. It will, however, lend its aid and assistance as far as practicable, to private individuals who desire to attempt reforesting on their own account. It is proposed, as far as practicable to appoint as local rangers men who have some knowledge of establishing nurseries and propagating trees, who will advise and assist private owners in their forestry operations.

In several districts active plans are being formulated for the establishment of forestry reserves, and within the year we hope to see great progress made in this line.

Much will depend upon the activity of the local forester and the disposition of the local land owners.

A liberal disposition has been manifested by most of them, and if their deeds are as fair as their words, rapid settlement of the lines of the forest reserves may be expected.

*RECIPROCITY WITH CUBA.**

By H. Parker Willis, Ph.D.,
Washington and Lee University.

The practical abrogation of the McKinley treaties in consequence of the passage of the Wilson Act in 1894, might have led to a decline in trade with Cuba under any circumstances; but, as already intimated, the actual falling off must be attributed in part to general disturbances within the island. It seems to be clear, however, that the loss of the reciprocity treaty with the United States was sharply felt, and when, after the Spanish war, the question of making the Platt amendment an integral part of the Cuban constitution came up, the desire of certain sugar interests for reciprocity made its appearance in a distinct form. President McKinley's alleged pledge to the Cubans that they should have a reciprocity treaty with the United States was probably given, if at all, without fully taking account of the fact that a sugar industry had grown up since 1890, which was determined to permit no infringement upon its protected preserves. On the other hand, it is quite likely that Mr. McKinley, in making such a pledge—if pledge there was—fully realized that the step would be not displeasing to certain sugar interests in the United States which had acquired control in Cuba. The situation was rendered more difficult by the fact that the Dingley Act, which had, in 1897, superseded the Democratic legislation of 1894, had not replaced sugar on the list of reciprocity commodities in which treaties might be made solely by executive authority. It was, therefore, necessary that any reciprocity treaty with Cuba should receive the special sanction of the Senate, since sugar and tobacco were the only articles in which it would have been worth while for Cuba to negotiate an agreement. Out of such circumstances grew the now familiar Cuban reciprocity struggle of 1901-1903. This struggle was the particular work of President Roosevelt, who, on succeeding Mr. McKinley, gave an informal pledge to continue the policies of his predecessor so far as practicable. It being supposed that President McKinley had definitely committed himself to the support of reciprocity with Cuba, this, therefore, was one of the inheritances thought to be carried over from the McKinley administration to its successor.

In his first annual message to Congress, presented at the opening of the session, 1901-1902, President Roosevelt used the following words:

"In Cuba such progress has been made toward putting the independent government of the island upon a firm footing,

* Annals of the American Academy of Political and Social Science.

that before the present session of the Congress closes this will be an accomplished fact. Cuba will then start as her own mistress; and to the beautiful Queen of the Antilles, as she unfolds this new page of her destiny, we extend our heartiest greetings and good wishes. Elsewhere I have discussed the question of reciprocity. In the case of Cuba, however, there are weighty reasons of morality and of national interest why the policy should be held to have a peculiar application, and I most earnestly ask your attention to the wisdom—indeed, to the vital need—of providing for a substantial reduction in the tariff duties on Cuban imports into the United States. Cuba has in her constitution affirmed what we desired—that she should stand, in international affairs, in closer and more friendly relations with us than with any other power; and we are bound by every consideration of honor and expediency to pass commercial measures in the interest of her material well-being."

He thus unhesitatingly declared himself for Cuban reciprosity. He did more than this. He put the matter before Congress in such a way that it could not escape the consideration of the subject. He did not allow the political tricksters quietly to shirk the reciprocity issue, as they had done for several sessions past, but he employed all the machinery at his command to force the issue upon Congress and compel that body to declare itself one way or the other.

As is well known, the issue was finally brought up in Congress apropos of a bill introduced by Chairman Payne during the session 1901-1902, and providing for a reduction of our duties, conditional upon a similar reduction to be made by Cuba in her tariff. This reduction was to be 20 per cent., but even so small a decrease as this was resisted by our domestic sugar-growing interests in a way that gave rise to the bitterest fight that had taken place within the Republican organization for a long time. How this struggle turned out; how the lower House finally passed the Payne bill, with a provision conditioning the reduction of duty upon a recasting of the sugar tariff in a way which would be distinctly distasteful to the refining interests which were supposed to be behind the Cuban reciprocity movement; how the bill was finally sent to the Senate, and there ultimately hung up because of the difficulty of passing it without the amendments which were certain to be opposed by the refiners, is now a threadbare story. It was not until President Roosevelt had appealed to the country for support, and had made Cuban reciprocity an issue in the Congressional campaign that he could count upon a majority that would assent to Cuban reciprocity. In the meantime, however, the situation in Cuba had materially changed. The taunts hurled in the faces of the Cubans themselves by members of the Congress of the United States, the fact that the price of sugar had improved subsequent to the

decision of the Brussels Sugar Conference reached in the winter of 1901-1902, to abolish sugar bounties, and a variety of other circumstances had rendered the pressure from the Cuban side much less urgent. As a matter of fact, the administration found itself in an embarrassing position in the fall of 1902 through fear of what might happen if the Cubans should be unwilling to grant us reciprocity even in case we should be willing to allow it to them. Hence the sending of Major Tasker H. Bliss to Cuba in the early autumn of 1902 to negotiate a treaty which should commit the Cubans to the idea of reciprocity with the United States, and which it might be easier to get ratified at this end of the line than a bill to the same effect. Major Bliss' return with the treaty, the outcome of the elections in favor of the administration, and other circumstances, fully convinced the domestic sugar growers that assent to Cuban reciprocity, in a formal way at least, would be unavoidable. In a convention held at Washington early in 1903 the domestic sugar growers, bowing to necessity, were graciously pleased to yield their assent to reciprocity with Cuba, but in so doing they had not yet said the last word. Their representatives in the Senate succeeded in introducing into the document prepared under the direction of Mr. Bliss, a clause which, if it shall be ultimately preserved, will mean the total and ultimate sacrifice of South American reciprocity for many years to come. The clause in question provided that so long as the treaty should last, it should not be lawful to reduce the duty on sugar coming from any other country than Cuba below the rates fixed by the Dingley tariff. It is upon such conditions that the Senate has ratified the treaty, which now awaits only the sanction of the House of Representatives to become law. The addition of this remarkable provision to the treaty by the domestic sugar growers adds another element of doubt to a situation already doubtful, and makes it of double importance to decide whether we can afford to pay the price demanded for the whistle called "Cuban reciprocity."

The grounds upon which reciprocity with Cuba may be urged were fully stated in President Roosevelt's message to Congress of June 13, 1902. In that message the President pleaded for reciprocity from four distinct standpoints. He contended that such reciprocity should be granted (1) because of a moral obligation to Cuba; (2) because of an alleged pledge given at the time the Dingley Act was passed to adopt and put into force reciprocity treaties, owing to the unduly high tariff rates which had been provided for, with the distinct intention of lowering them when it should be practicable to negotiate such agreements; (3) because of the increased commercial advantages which would accrue to us in consequence of the compensating reduction of duty to be made by Cuba; (4) because of political advantages resulting from the

influence in Cuba probably to be acquired by us in consequence of generosity to the island.

This statement of arguments made by President Roosevelt fairly sums up what has been said by the pro-reciprocity pleaders of recent years. At first sight, it appears to be a rather heterogeneous mixture. It seems to prove too much. Any one of the arguments thus set forth would, if fully substantiated and allowed to stand alone, be a sufficient plea for the cause in behalf of which it is cited. But when it is sought to establish that the policy in question is the dictate alike of moral obligation, business advantage, political policy and a promise already given, the argument seems almost to fall of its own weight. We can hardly do better, however, than to consider these arguments one by one, coming as they do from so authoritative a source and summing up most of the current discussion of the subject.

Of the various arguments for reciprocity with Cuba, none perhaps is hazier than that which claims a moral obligation on our part. This argument seems to be based upon two distinct contentions. The first of these is that President McKinley had promised such a reciprocity treaty. The second is that the Platt amendment, incorporated by the Cubans into their constitution was in itself such a pledge, or at all events evidence of such a pledge as, it has been claimed, President McKinley gave. Of the two arguments thus advanced, little or no weight needs to be given to the alleged promise of President McKinley. It has again and again been stated that such a promise was given, but up to the present time no documentary evidence to that effect has been submitted. On the other hand, it has been repeatedly stated on the floor of Congress that no such pledge had been offered, but that the Cuban delegation in Washington mistook kind words and promises of support from the President for an agreement on his part to see the reciprocity treaty through Congress. This portion of the claim, therefore, may evidently be neglected; and when it is further considered that, even supposing that such a pledge had been given, it must have been made without any authority from Congress, it is sufficiently plain that both the evidence that such a promise existed and any binding quality in the hypothetical promise, if it was ever made, are absent.

A more serious phase of this argument is found in the contention that the Platt amendment to the Cuban constitution constituted a practical pledge on the part of our Congress. Yet investigation will show that this argument is as empty as its companion piece.

The army appropriation bill containing this amendment was adopted by the Senate February 27, 1901, and finally became law March 2, immediately following. As soon as the provisions of the Platt amendment had become known in

Cuba there ensued a period of heated discussion. Many maintained that the Platt amendment would practically result in destroying Cuban independence. The right retained by our government in clause III to intervene for the preservation of Cuban independence, etc., was considered as giving us the authority to intermeddle with the affairs of Cuban government. An effort was made to destroy this impression by means of a dispatch sent by Secretary Root to General Wood on the 3d of April, in which the authority feared was expressly disclaimed. In spite of this protest, however, the Cuban constitutional convention continued to hesitate until finally, June 12, 1901, it adopted an ordinance identical with the terms of the Platt amendment.

In discussing this important document, it does not appear that anything was said in Congress which would throw light upon the proper interpretation of clause I, regarding the power of Cuba to make treaties with foreign nations, except the general statement that the island should not thereby impair its independence. Commercial treaties were nowhere mentioned in the course of debates. Most of the discussion hinged upon our power of interfering in Cuban affairs for the purpose of preserving the independence of the island. The effort was made by amendments to the amendment to limit the authority granted in clause III, to interfere with the affairs of the island, either in case of foreign aggression, or in order to insure Cuban independence. No success, however, attended these attempts.

What the debate did do was to indicate very clearly the political authority which it was supposed this country might, upon occasion, assume. Senator Hoar described the amendment as:

"Eminently wise and satisfactory.....In substance, a proper and necessary stipulation for the application of the Monroe doctrine to the nearest outlying country.....and under the circumstances one which the protection of the United States, as well as the protection of Cuba, fairly and properly requires.....I do not suppose that under this clause 3 the United States will ever undertake to interfere in such local commotions or disturbances as every country, especially every Spanish-American country south of us, is subject to. I do not suppose that is anybody's intention; but only in those grave cases where international interference is proper."

Naturally, the amendment was vigorously attacked by the Democrats, on the ground that to force such an amendment upon the Cuban Constitutional Convention was practically to violate our pledged faith in regard to the independence of the island by reserving the right to interfere and overturn the government whenever we might see fit. This view was expressed by Senator Jones, of Arkansas, in an extreme form:

"The reserving to the United States the right to maintain a government, the United States to be the judge of what that government is, adequate for the protection of life and property, would seem to me to be reserving to the United States the right to overturn the government of Cuba whenever it saw fit."

Senator Morgan took the same view, and further rebutted the contention of Mr. Hoar that the amendment was justified by the Monroe doctrine:

"The Monroe doctrine never had anything to do with a proposition like this.....It has no connection with that. That (Art. 3 of the amendment) gives us the right to go into one of these American states.....(to).....exercise the power of the government of the United States for the maintenance of a government adequate for the protection of life, property, and individual liberty."

Senators Pettus and Tillman also forcibly expressed the opinion that the amendment was a distinct violation of the pledge to establish in Cuba an independent government. And an amendment proposed by Mr. Morgan, stating that the resolutions were submitted for the consideration of the Cuban Constitutional Convention and not as an ultimatum to Cuba was lost. Nowhere was it stated by the author of the amendment or by its supporters, and nowhere was it complained by opponents, that the obligation to look after the economic welfare of Cuba had been assumed by us.

Little needs to be said of the contention that reciprocity with Cuba is desirable in order to assure our prestige in Cuba and to still further support our control in the West Indies and our power over a prospective trans-isthmian canal. Since we already hold Porto Rico, since we could doubtless get the Danish West Indies if we were willing to pay a moderate price for them, and since the conditions of the construction of the canal are such as to render control of it, on the whole, of little worth, it might be concluded that the political argument could safely be disregarded and that political power in Cuba would be of small value to us in carrying out our canal policy. It may be, however, that there are some who would not take this view of the situation, but who would consider the possible acquirement of political control in Cuba to be worth the reciprocity price we are asked for it. To such persons, it would seem sufficient to suggest that the Platt amendment gives us all the political power in Cuba that we could properly obtain by any means whatever short of annexation. If, therefore, President Roosevelt and those who agree with him mean that reciprocity would be an easy means of promoting annexation (as was the case with Hawaii), this phase of the argument should be made clear. It is safe to say, however, that were it thus made clear it would call in few fresh supporters to the reciprocity movement. That the

Dingley rates were put at a high figure for reciprocity purposes is undoubtedly true, but is an argument for reciprocity that applies quite as fully to all reciprocity as to reciprocity with Cuba. If, moreover, the latter will impede the general cause of reciprocity, argument based on the Dingley rates must fall to the ground.

The truth is that in discussing reciprocity with Cuba, the only argument that is really worthy of consideration is the claim that advantages in trade will accrue to us from such a relation. The question of trade may be looked at from two standpoints, that of Cuba and that of the United States. If we adopt the standpoint of Cuba, it will appear that the advantage to the inhabitants of the island flowing from reciprocity must depend upon whether they can succeed in getting a higher price for their products—chiefly sugar—in New York under a reciprocity agreement than they could if no such agreement existed. This is turn will depend upon two factors, viz: whether there be any demand for the Cuban product in New York and whether the product when raised and marketed in Cuba is or is not actually in the hands of Cubans or is owned by foreigners. While the ownership of Cuban lands cannot be definitely stated, it is certain that large amounts of American and other foreign capital have been invested there, and that the benefit to be derived from sales of sugar at profitable prices would accrue only in part, if at all, to Cuban planters. Much sugar is sold on the spot to American buyers at ruling prices. It is also very questionable how far the ability to send sugar into the United States free of duty would benefit the planter since the existence of a close monopoly of the business of refining must inevitably imply as close a control of the demand for sugar and bestow upon the group of individuals who manage the refining industry the power to depress the price of the Cuban product by refusing to buy it. If in fact our refiners should, as is largely the case, pursue the policy of buying in Cuba at the rates established in the world market, and of buying no product in New York, it seems to be certain that the benefit of a tariff reduction would go to a considerable extent, if not wholly, to the refiners. In any event, none of the advantage would go to the American consumer, first because of the existence of the refining monopoly in the United States, and second because of the fact that our need for raw sugar so largely exceeds the supply of that article which could be produced in Cuba. So far as trade is concerned, therefore, it seems unavoidable that the advantages to be reaped from a reciprocity treaty will accrue chiefly to the American sugar refiner, and to some American manufacturers who may find in Cuba a market for their products which they would not otherwise have. Considering in the interests of the American manufacturer, it is impossible to suppose that a 20 per cent. reduction in our present high rates of

duty would have as powerful an effect in turning Cuban trade towards us as did the free admission of Cuban sugar to the United States which occurred in pursuance of the treaty negotiated in accordance with the McKinley act. Yet under the McKinley act, our exports to Cuba increased only by from seven to twelve million dollars above what they had been prior to the negotiation of the treaty, while our imports increased by some twenty-five million dollars, this increase being largely in sugar. The duties lost by us on the large increase in sugar imports were then greater than the total volume of trade added to our export business with Cuba in consequence of the reciprocity treaty. While it is true that the amounts of duties now to be sacrificed under the proposed reciprocity treaty will be much smaller than at the time of our former experience, it is also true that the pull to be exerted by us upon Cuban trade will be, as just shown, much smaller now than it was then since the reductions of duty then offered to us ranged from total free trade on some articles to 50 per cent. on others, while the smallest reductions of duty contained in the treaty were 25 per cent. On the whole, therefore, it is fair to expect that the amount of trade gained by our manufacturers would be smaller than the duties lost by the United States in consequence of reciprocity, and which would probably be paid, as we have seen, into the pockets of the refining monopoly which constitutes the sole market for the Cuban product in the United States.

As compared with the concessions granted us under our former treaty of reciprocity with Cuba, the reductions made in the new agreement do not seem very satisfactory. In return for the reduction of 20 per cent. which we are to make upon all Cuban products, we shall receive a reduction of 25 per cent. on machinery composed of copper, manufactures of cast iron and steel, cotton and manufactures thereof, and various other articles. We shall also receive a reduction of 30 per cent. upon butter, chemical products and drugs, some liquors, and certain manufactures, while 40 per cent. is granted on knitted cotton manufactures, preserved fruits, paper pulp, wool and manufactures thereof, silk and manufactures thereof, rice and cotton. By a comparison with a treaty of 1891, it will be seen that many of the manufactures upon which we are now to receive a reduction of 25 per cent. were admitted free under the original treaty, while many of those on which we are to receive a reduction of 30 per cent. or 40 per cent. were granted a reduction of 50 per cent. under the earlier treaty. It would seem that there are few articles which receive better treatment under the new treaty than they did under the old. This is natural, since our concessions to Cuban products are so much smaller than they were formerly, it being understood that sugar constitutes the bulk of Cuban exports to the United States. While the number of

articles of Cuban production actually mentioned in the McKinley act was small, the fact that they were admitted free of duty much more than makes up for the fact that we now propose to let in a large range of articles which are imported either not at all or in very small amounts.

A prime consideration worth attention in connection with the pending treaty has been already suggested. This is the amendment which was added to the treaty of the beet-sugar men in the form of an addition to Article 8. That addition ran as follows:

"Provided, that while this convention is in force, no sugar imported from the republic of Cuba, and being the product of the soil or industry of the republic of Cuba, shall be admitted into the United States at a reduction of duty greater than 20 per centum of the rates of duty thereon as provided by the tariff act of the United States approved July 24, 1897, and no sugar the product of any other country shall be admitted by treaty or convention into the United States while this convention is in force, at a lower rate of duty than that provided by the tariff act of the United States approved July 24, 1897."

It will be recalled that the commission sent by us to South America in 1884 reported distinctly that "in any convention we, on our part, must admit wool or sugar free of duty, or at greatly reduced rates." It has for a long time seemed to be out of the question to think of securing tariff reductions in wool, and if reductions in sugar are similarly put out of the question by a clause like the one just quoted, we shall be cut off from the use of either wool or sugar as a basis for South American reciprocity. Inasmuch as the South American commission regarded these commodities as the only ones upon which South American reciprocity could be based, it seems also clear that cutting ourselves off from these means cutting ourselves off altogether from any possibility of South American reciprocity. That being the case, the passage of the Cuban treaty will be a serious defeat for the cause of reciprocity in general, and, since most of the Kasson treaties were founded upon concessions in sugar to South American countries, the acceptance of the Cuban agreement will mean that the Kasson treaties have been definitely laid upon the shelf for all time to come.

There is another point well worthy of note in connection with the pending reciprocity treaty. This is that we are already doing all that could be expected of us in protecting Cuba, by our policy of levying discriminating duties on sugar coming from other countries. Under the McKinley act of 1890, we merely admitted free the sugar product of Cuba along with that of several other large sugar-producing countries. Of these countries, some at least, paid export bounties so that Cuban sugar, even when it enjoyed a free entry into the markets of the United States, was in an unfavorable position

as compared with the products of other countries. At the present time this situation does not exist, since we levy our discriminating duty on all bounty-fed sugars,—to which class that of Cuba does not belong. For that reason, Cuban sugar is really better off with regard to the United States market than it ever has been in the past. Should we grant to Cuba a reduction of 20 per cent. in our tariff on sugar while at the same time we gave it the discriminating duty, we should be offering altogether unnecessary advantages to Cuba, and since, by the terms of the treaty, it is proposed that we cut ourselves off from making similar tariff arrangements with other foreign countries, these other countries would have, if they chose to seek it, unmistakable ground for complaint.

The truth is that reciprocity with Cuba, in its present shape, is a matter of no interest whatever to our consumers, and of very little interest to our manufacturers. It is of importance to the Americans who have become interested in Cuban lands, and it is of importance too, to the refining interest which hopes by this means to get its raw material cheaper. How far it will help the Cuban planter is problematical. To the American statesman, interested in our foreign relations, it is a question of absolutely no consequence unless he be an annexationist, for we already have a sufficient control of the West Indies and all the political influence in Cuba that reasonable men could wish for. Seldom, perhaps, in our history. has there been a more needless and unwarrantable drain upon public emotion and sympathy than in the case of the Cuban reciprocity controversy.

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PRODUCTION OF SUGAR IN HAWAII—EVAPORATION.

By E. Kopke.

The paper read at last meeting treated of the subject of mi'ling and maceration. It is my intention to follow the flow of juice through the boiling house and take up the by-processes afterwards; by this I mean the manipulation of filter presses, the treatment of molasses and molasses sugars, and the consuming of the bagasse as fuel will be taken up after the main work of the boiling house has been described —i. e., the process of obtaining the first sugar out of the mill juice.

One of the most important things in the manufacture of sugar from cane is the process of cleaning the juice. The juice carries with it as it comes from the mills mainly two impurities: 1st, those in solution, of which I have already spoken in connection with the co-efficient of purity; and 2nd, the mechanical impurities, such as earth, cane fibre, &c.

The first kind of impurities (those in solution) may under certain conditions become very serious detriments to the manufacturing process. The nature of these impurities depends upon the condition under which the cane has grown.

If the cane has grown on soil which has been under cultivation for a long time, and has been fertilized correctly, and the cane has grown to maturity, a comparatively pure juice will be the result; if, however, the cane has grown on new land that is virgin soil, then the juices are as a rule much more impure. The plant takes up through its roots parts of the soluble matter in the soil, and therefore the conditions of the soil govern to quite a degree the condition of the juice. The conditions of the soil can to some extent be regulated by proper treatment—for instance, by drainage, fertilizing and cultivation, as by raising some plant on the land prior to the planting of cane which will take up those solutions in the soils which are objectionable in cane juice. To know exactly what to do in regard to the treatment of the fields, it is necessary to make chemical analyses of the soil and be guided by them to a great extent.

I have wandered from the subject of manufacturing sugar in order to show what may cause the impurities in the juices. But now we will return to the treatment of the juices. When the juice leaves the different mills, it carries with it a great deal of bagasse which is strained out before the juice goes into the supply tank of the juice pump. The juice pump moves the juice into liming tanks. The object of liming the juice is to neutralize acids formed by fermentation, and to stop the fermentation.

If the acidity of the juice was not neutralized by some alkali, the inversion of crystallizable sugar to non-crystallizable sugar would go on and soon destroy all sugar.

The next process the juice is exposed to is clarification. Under clarification is understood the heating of the juices, the decanting of same in settling tanks, and filtration. Filtration, however, is in some factories omitted.

The aim of this clarifying process is this—that all impurities, as far as possible, shall be removed from the juice. It can readily be seen that the mechanical impurities, such as earth and cane fibre, can be eliminated by settling or filtration, or both; but the impurities in solution are almost beyond our reach, except the albumenoids, which may be coagulated by heat and then precipitated or filtered. The best-known albumen is the white of an egg, which, as every one knows, readily coagulates when heated. The albumen in cane juices does not coagulate as readily as the white of an egg by just boiling for a few moments. It is quite important that this heating of the juice to the point of coagulation is done thoroughly, for if it is not done thoroughly the uncoagulated albumenoids pass to the different boiling apparatus

(evaporators and vacuum pans), where the coagulation takes effect, and may cover the heating surfaces, reducing the efficiency of same.

If juices are heated in the clarifying process to, say 200 deg. F., and these same juices afterwards are exposed in the (hot or) first cell of a quadruple effect to 210 deg., as generally is the case, precipitation of coagulated albumenoids will take place and foul the heating surface and reduce the efficiency of the apparatus.

One can see at a glance how important it is that this process of clarifying the juice be done intelligently and thoroughly. The impurities passing on with the clarified juice cannot be gotten hold of any more; at least there are no means employed on these islands, as far as I am aware, to filter the syrups. These impurities becoming concentrated with the syrup and massecuite, form the obstacle to separate the sugar from the final molasses. In other words, the losses of sugar in the final molasses depend upon the impurities they contain.

So far I have spoken of impurities which we have means to remove; now comes the more difficult sort—those that remain in solution through the process of heating, but will precipitate when the juices become concentrated.

If we boil a solution of salt and water so that the water evaporates, we will find that after a certain amount of water has been expelled by evaporation the salt begins to precipitate—that is, there is not enough water present to hold *all* the salt in solution.

We have the same phenomena with all other solids in solution, only some need more water to dissolve them than others, and those solids needing the most water to dissolve them will be the first ones to precipitate in the process of evaporation.

If we examine closely the precipitate in the different cells of an evaporator, we will most likely find quite a marked difference in the nature of the precipitates in the different cells. The first or hottest cell will show coagulated albumen and vegetable matter, which has escaped the filter or settlers, mixed with lime and earth. The second and third and fourth cells will show this in a less degree, but generally a deposit of such solids which are held the longest in solution. One can only speak of the deposits in the different cells of an evaporator in general, as there are not two places that show exactly the same deposits, for the reason that the impurities in the juices are not the same in two different places; in fact, the different fields on the same plantation often show great differences, and for that reason a process of clarification giving good results in one place may not give good results in another place. And it is especially the duty of the chemist to determine what the impurities consist of, and give, if possible, hints about the treatment. The condition of the juices

is sometimes such that they become baffling, especially where cane is grown on virgin soil or on land which has never been planted with cane.

Experiments have been and are now being made to purify sugar solutions by the electrolitic process, which of course every one interested in sugar hopes to see mature into something applicable; until then, however, we must go on as best we know how, and intelligent research and everlasting vigilance will do much to overcome obstacles.

All those solids which remain in solution longer than sugar pass on and are gotten rid of in the final molasses, each one carrying its quota of sugar with it, and the losses by this amount to as much as 5 per cent., or even more.

The next step in the manufacture of sugar after clarification is *concentration*—that is, evaporation of the greater part of water (about 75—80 per cent.) out of the clarified juices.

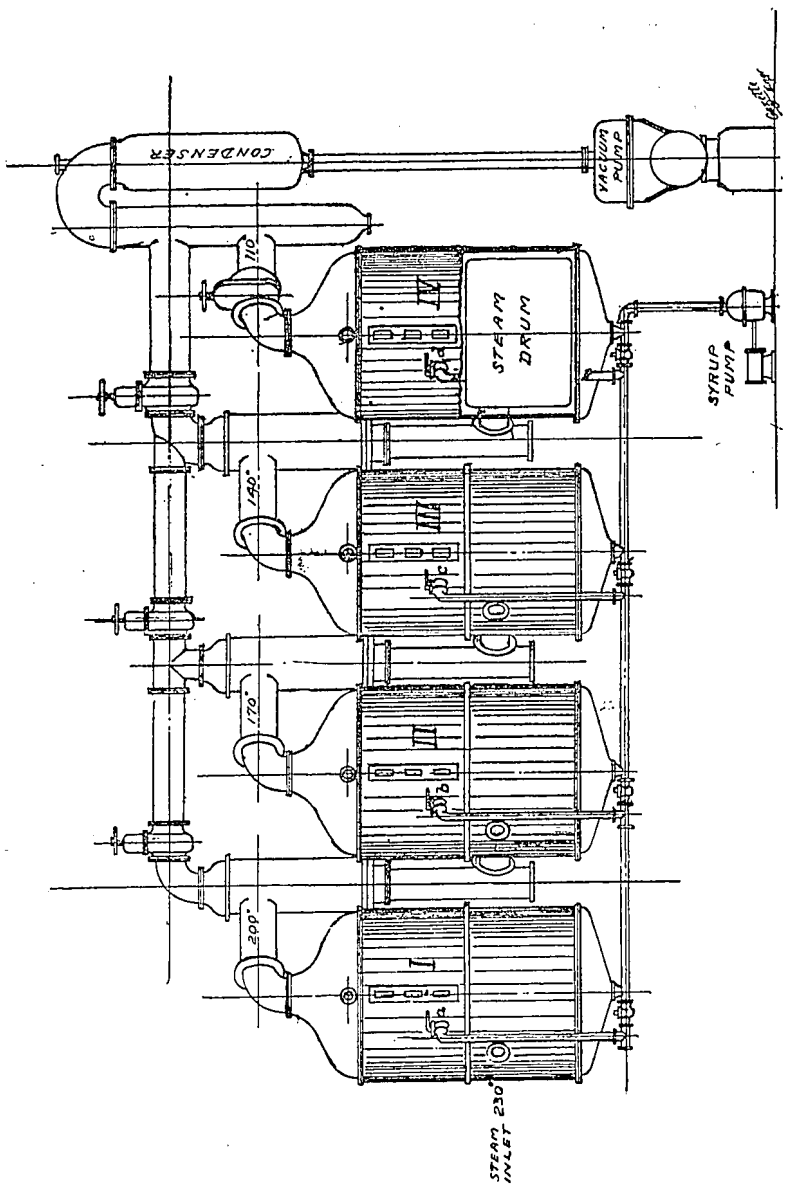
The process of evaporation is now almost exclusively carried on in so-called multiple effect, generally of the quadruple type.

The method of evaporating in a multiple effect is resorted to on account of its economy in steam over the open evaporation.

While in an open evaporator all the steam from the clarified juice escapes into the atmosphere and is lost, it is made to do in a quadruple effect theoretically four times as much as in an open evaporator. If thin juices are heated in an open evaporator they boil—that is, give off steam—at 212 deg. F. (or a little above this). If the heating was done the same as in a steam boiler, we have reason to presume that one pound of coal would evaporate about 8 pounds of water; and if the assertion is right that a quadruple effect will do the same amount of work with one-quarter the amount of heat (or coal), then one pound of coal will evaporate $4 \times 8 = 32$ lbs. of water. (This is the theoretical amount; in practice I think that not more than 24 lbs. of water to 1 lb. of coal is obtained on an average, because all heat consumed by the apparatus must be charged against it, and this includes the energy of pumps and other power machinery to operate the apparatus and radiation; also heat that may be carried off in the syrup leaving the apparatus.)

Now let us see how it is possible to make the steam, or rather the heat, that enters the first cell do the work of boiling in the three following cells.

If we look at the sketch, you see four cells arranged in a series marked I, II, III, IV. Each one contains a steam drum. The arrangements are not always the same. (I have chosen this type of evaporator just to illustrate the process. This type, by the way, is called the standard effect, and I may mention right here that there are dozens of different types.)


CONDENSER
VACUUM PUMP
STEAM DRUM
STEAM PUMP
110°
150°
170°
200°
STEAM INLET 230°

No. I is connected to No. II by a vapor pipe. This vapor pipe conducts the steam or vapor from the juice in cell I to steam drum in cell II, and you see the same connection between Nos. II and III, also III and IV, but No. IV has its vapor go into a jet condenser, where they are condensed and drawn off by a vacuum pump. I have also shown the juice connections —that is, the connection which allows the juice under treatment to flow from one cell to the other. As you see, the juice enters No. I cell, flows through at a rate regulated by the opening or closing of the cocks a, b, c, d, and is drawn out of the IV cell by a syrup pump.

Now imagine all four cells filled with juice as indicated, and steam is allowed to enter the steam drum at 230 deg., which represents about six pounds pressure, and the vacuum pump, which has been set a-going and has produced a partial vacuum in all the cells, the juice will boil and give off vapor, which passes through the vapor pipe into drum of cell No. II, &c. You will see in the case I have assumed here that the difference of temperature between steam in drum No. I and juice in No. I is 30 degrees, and the differences in all others are the same; and this difference is what makes the juices boil and give off vapors in the different cells, but these differences only can be maintained by reducing the pressure in the right proportion, and this is done by the vacuum pump and condenser.

What I have said in regard to difference in temperature is not quite true. The differences of temperatures become greater in the colder cells than in the hotter ones, and it is easily explained why it should be so. It takes less energy to evaporate water from thin juice than from syrup.

An example of differences in pressures and temperatures under which a quadruple effect would do good work is the following:

STEAM SPACE.

(1)	Cell	Temp. of	41|2 lbs.	per sq. in.	=226°
(2)	"	"	0 "	"	=212°
(3)	"	"	9" Vac.		=197°
(4)	"	"	18" "		=168°

VAPOR SPACE.

					Diff.
(1)	Cell.	Vapor	0 lbs. per sq. in.	=212° F.	
(2)	"	"	9" Vac	=197°	15°
(3)	"	"	18" "	=168°	29°
(4)	"	"	27" "	=115°	53°

The differences will change by increasing or decreasing the temperatures in steam chamber of first cell, or by increasing or decreasing the vacuum in last cell.

As you will observe, the vapor from last cell goes into the condenser with 115 deg. F., while, if the evaporation had gone on in the open air, it would have escaped with 212 deg. F.

While this is not a demonstration of the work that is being done in a multiple effect, I hope that the illustration has been sufficiently clear to lead to the next subject on different types of evaporators.

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BAGASSE BURNING FURNACES.

By H. G. Ginaca.

This paper is confined to conditions as they exist in the Hawaiian Islands.

Bagasse is the woody fibre refuse of sugar cane discharged from juice-extracting machinery, and contains between 40 and 45 per cent. water, the rest being combustible solubles, woody fibre and ash elements. The composition of dry bagasse in round numbers is: 80 per cent. volatile matter, 15 per cent. fixed carbon, and 5 per cent. ashes.

The percentage of heat required to evaporate the water contained in the bagasse is not as great as it may appear to be.

Of the total heat in average bagasse it requires about 10 per cent. to evaporate its water, leaving from 3,500 to 4,000 B. T. U. available per pound.

It is difficult to compare the efficiency of the boiler plants of mills in different localities by the amount of fuel being consumed. The amount of fuel consumed to generate a certain amount of steam depends upon the quality of the bagasse, the efficiency of the furnace, the efficiency of the boilers and the temperature of the feed water. The amount of steam required to operate a sugar mill depends upon the efficiency of the steam-consuming apparatus, the quality of the cane juices, the amount of maceration and wastes. Some mills have special apparatus which others do not employ. Owing to local conditions, some mills pump the water used for condensing and other purposes, while in others it flows to the mill by gravity. A surplus or a shortage of bagasse is no positive indication that the boiler plant in one mill is doing better or worse than that of another.

The most efficient furnace is one which will deliver to the boiler the greatest weight of gases at the highest temperature from a given amount of fuel.

Furnace efficiency is of little importance to plantations that have a surplus of bagasse which cannot be utilized for other purposes outside of mill work, but where outside fuel has to be used in addition to the bagasse from the mill it is of importance that this matter be investigated, and that the highest furnace efficiency be obtained.

It is my aim in this paper to describe types of bagasse-burning furnaces, their operation, defects and possible remedies.

The bagasse-burning furnaces in general use are known as the "Dutch oven" type, and are from four to six feet in width. The grates usually adopted are of the step-ladder type. Bagasse is fed to the furnace either by hand or automatically.

Fig. 1 represents a type of furnace as first constructed, many of which are still in use. The grate bars start from the rear wall and step upward to the front wall of the furnace at an angle between 40 and 45 degrees. In the front wall, and directly above the grate, are the firing-door openings. In the front wall, and below the firing doors, are the ash-pit doors leading under the grates. The rear wall is carried upward and backward, terminating in a bridge-wall underneath the boiler. In this wall are often introduced hot-air pipes or passages admitting air high above the grates. The top of the furnace is arched and projects from the front wall, terminating under the front end of the boiler. This type of furnace is usually fed by hand.

Fig. 2 represents a furnace similar in many respects to that shown in Fig. 1, except that a horizontal grate is introduced between the bottom of the step-ladder grate and the rear wall. A space is usually left between the top of this horizontal grate and the lowest step-ladder grate-bar for the purpose of removing ashes and clinkers. The horizontal grate-bars are carried well forward, so that bagasse cannot fall in the ash-pit. Owing to the construction of the grate shown in Fig. 1, when a charge of fuel is fed to the furnace by hand, it piles up in the angle formed by the grates and the rear wall. The horizontal grate shown in Fig. 2 is an improvement over that of Fig. 1, as it permits of the easy removal of the ashes and clinkers, and the bagasse, if fed by hand, becomes more evenly distributed over the horizontal grate. The furnace is also extended further beyond the end of the boiler. Through the arch at the front end is an opening over which is placed an automatic or other arrangement for feeding the bagasse.

Fig. 3 is a modern setting, with the furnaces carried out far beyond the front of the boiler, making a long arch, all other parts being similar to that shown in Fig. 2. This type of setting permits of the opening of the front tube door without interfering with the feeder, and also isolates the furnace from the boiler.

The combustible elements of bagasse with which we have to deal are carbon, hydrogen and oxygen.

Hydrogen and oxygen combine in the proportion of two atoms of hydrogen to one atom of oxygen to form water, and in doing so evolve 62,100 B. T. U. per pound of hydrogen. Carbon and oxygen combine in the proportion of one atom of

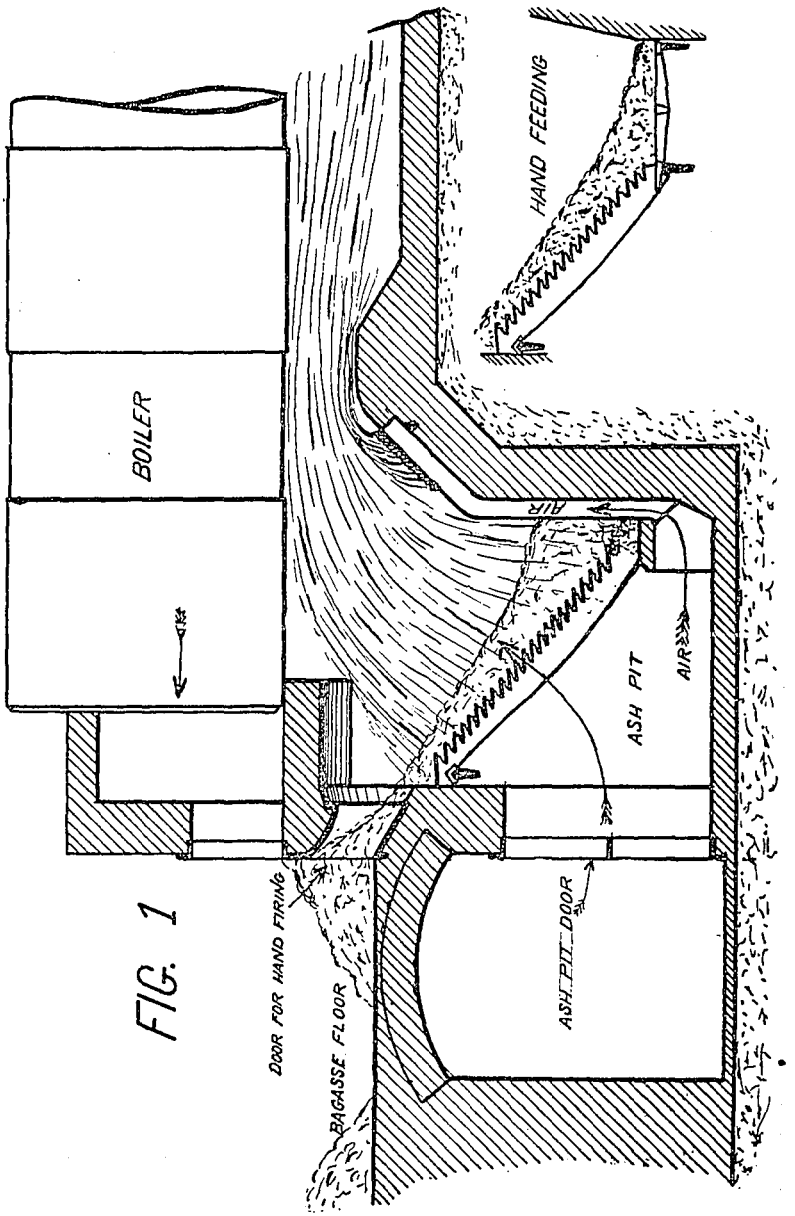
BOILER
HAND FEEDING
AIR
ASH PIT
AIR
ASH PIT DOOR
DOOR FOR HAND FIRING
BAGASSE FLOOR

FIG. 1

carbon and two atoms of oxygen to form carbon-dioxide, and in doing so evolve 14,650 B. T. U. per pound of carbon. This is a product of complete combustion. Carbon and oxygen combine in the proportion of one atom of carbon to one atom of oxygen to form carbon-monoxide, and in doing so evolve 4,400 B. T. U. per pound of carbon. This is a product of incomplete combustion. The great loss of heat due to the incomplete combustion of carbon is clearly presented in the difference between the total heat of combustion of carbon-dioxide and that of carbon to carbon-monoxide.

Assume that the bagasse automatically fed onto the grates at the top is being evenly distributed, and a thick bed of fuel is burning at a moderate rate. Immediately on entering the furnace the bagasse becomes scorched by the heat, and the process of evaporating the water and the distillation of the volatiles begins. Before the volatiles or hydro-carbons can burn, they must be in a gaseous condition. The process of evaporation and distillation continues until all the moisture and volatiles of the bagasse are expelled, leaving the free carbon and ash elements. Owing to the structure of cane fibre, when the volatiles have been all expelled, the remaining carbon is left in a condition where it easily pulverizes and can blow along like dust. While the process of evaporation and distillation is going on the bagasse is slowly creeping or rolling down the grates, so that the greenest bagasse is on top. The bed of fuel is also sinking toward the grate-bars as it becomes consumed, so that we have bagasse in all stages of distillation from the top of the fuel bed, until nearest the grate-bars are the free carbon and ash elements.

It would be a difficult matter to determine in detail the exact order of the process of combustion in a bagasse furnace, but it is certain, however, that the final results of perfect combustion should be carbon-dioxide, water and nitrogen. When hydrogen and oxygen exist in a compound in the proper proportion to form water, its constituents have no effect on the total heat of combustion.

As previously stated, the carbon finds itself in a glowing condition nearest to the grate-bars, where it comes in contact with the air first entering the bed of fuel. The carbon being in a state of incandescence, is prepared to enter into combination with the oxygen gas in the air to form carbon-monoxide or carbon-dioxide and evolve heat. The volatiles or hydro-carbons being distilled will also combine and generate heat, provided the supply of oxygen is sufficient and their temperature is high enough to permit of their union.

In consideration of the great number and variety of interstices existing in the bagasse and of the various stages of combustion to which different portions of the fuel have attained, it is evident that in their passage through the fire

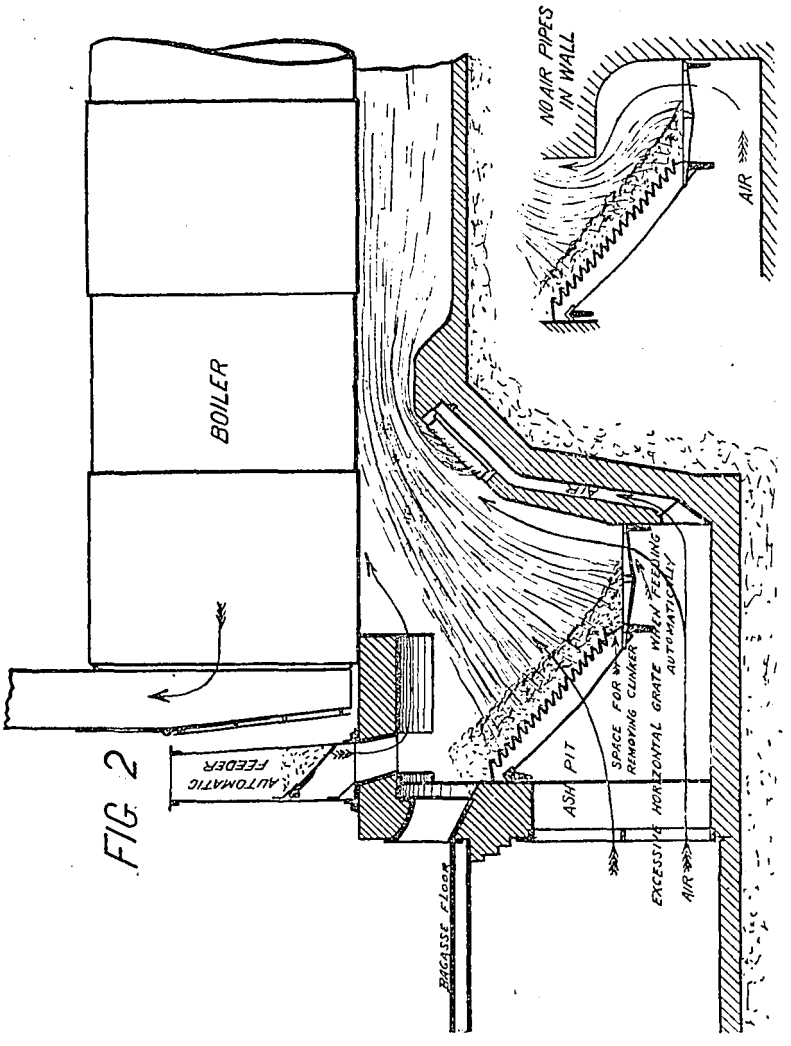
BOILER
AUTOMATIC FEEDER
BAGASSE Floor
ASH PIT
SPACE FOR REMOVING CLINKER
EXCESSIVE HORIZONTAL GRATE WITH FEEDING AUTOMATICALLY
AIR
AIR
NO AIR PIPES IN WALL
AIR

FIG 2

many changes must take place in the composition of the gases. Association and disassociation follow in rapid succession. In just which combination the carbon, hydrogen and oxygen gases shall leave the fire and pass to the boiler depends upon the temperature of the gases and the proportion of oxygen at hand.

Owing to the large amount of moisture present in bagasse, heat is absorbed from the gases and combustibles in the furnace to convert this water into steam. The steam thus generated becomes superheated till its temperature about equals that of the gases and combustibles surrounding it. Considerably more heat is required to superheat the steam than to evaporate the water. No possible gain in heat can be obtained from this steam. If the temperature in the furnace is high enough, the steam is decomposed into hydrogen and oxygen. The heat absorbed by the reduction of one pound of steam to hydrogen is much greater in amount than the heat generated by the union of carbon with the oxygen thus set free and forming either carbon-monoxide or carbon-dioxide. Consequently, the effect of the decomposition of water in the presence of incandescent fuel is to chill it. This loss may be recovered if the hydrogen of the steam is subsequently burned to form steam again. In practice, it may be doubted whether this restoration is ever complete. If disassociation does not occur, some of the heat from the superheated steam becomes absorbed by the boiler, but its volume in either case increases the velocity of the gases passing its cooling surfaces. There being a large percentage of combustible gases in the furnace above the bed of fuel, if the steam that is absorbing their heat reduces their temperature to a point where they can no longer combine, they will pass off to the chimney unconsumed. If too much cold air is admitted the same result will be obtained. It is then evident that the temperature of all parts of the furnace must be kept up high, so that when steam or air has extracted heat from the combustibles they are still at a temperature high enough to permit of combustion. It is a well-known fact that the condition of success in burning bagasse, or other wet fuels, consists in completely surrounding it with heated surfaces and rapidly evaporating the moisture.

The furnaces shown in Figures 1 and 2 are almost directly underneath the front part of the boilers, while that shown in Fig. 3 is isolated. In the former cases the gases have a tendency to be cooled by radiation before leaving the furnace, while in the latter case they are not.

There is a mechanical operation going on all the time in a bagasse furnace which is one of the most important to consider. The nitrogen in the air is an inert gas merely absorbing heat from the burning mass, but its large volume, with

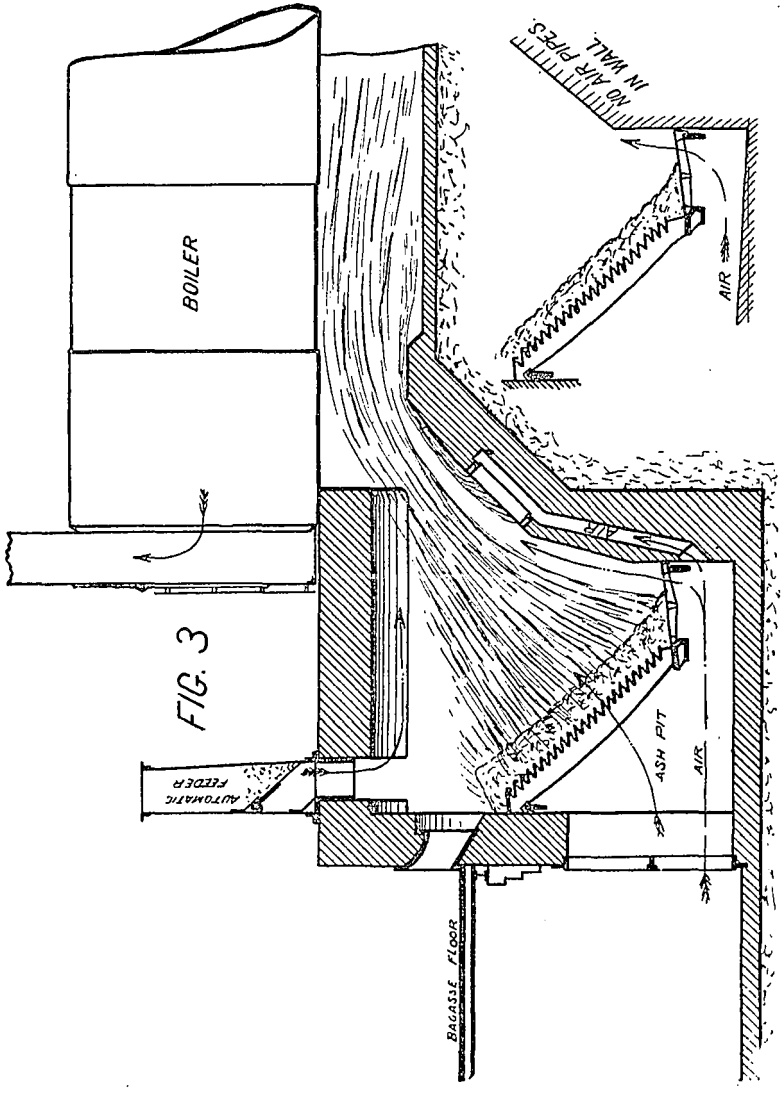
BOILER
NO AIR PIPES IN WALL
AIR
AIR
ASH PIT
AIR
AUTOMATIC FEEDER
BAGASSE FLOOR

FIG. 3

that of the gases formed, dislodge and carry through the fuel the fine particles of glowing carbon that are uncombined. These particles of carbon cannot obtain sufficient oxygen gas through the grate because the more air that is forced through the fuel the greater will be the number of particles dislodged. Fine particles of bagasse may be carried up by the draft from the fuel that will readily burn if the temperature is high enough and sufficient oxygen is present. It is also doubtful if a large portion of the hydro-carbons from the fuel, on account of their rising above the mass, can obtain sufficient oxygen gas through the grate for their complete combustion. Therefore, in burning bagasse, it is as necessary to supply air above the grates as below the grates. All combustibles that have risen from the fuel bed unconsumed must be brought in contact with oxygen as soon as possible to obtain their complete combustion. In many existing furnaces cold air is being introduced in various ways and at various points along the path of the gases. This air should not be introduced anywhere at random or at any temperature, but should come in contact with the combustibles as soon as possible after they leave the bed of fuel. This air should be previously heated and sent into the furnace at right angles to the currents rising from the burning mass, so that the oxygen can become thoroughly admixed with the combustibles and complete combustion accomplished wholly within the furnace.

Carbon-monoxide and carbon-dioxide are invisible gases, so that the particles of incandescent carbon blown up from the bed of fuel and the carbon set free in the breaking up of the hydro-carbons by heat, in rising with the gases, manifest themselves to us as flame. The flame from fuel is the larger the more slowly its combustion is effected. If sufficient oxygen is present and thoroughly admixed before the temperature is too low, these particles of incandescent carbon will all be consumed. If, however, the particles of carbon become cooled below the temperature of ignition before coming in contact with oxygen, they constitute smoke while floating in the gases, or soot when deposited on solid bodies.

To have an efficient boiler plant, it is as essential to have an efficient furnace as an efficient boiler. A good boiler may have an inefficient furnace, and a poor boiler may have an efficient furnace. Merely as an example, let us assume that the initial temperature of the gases to the boiler is 1,750 degrees Fahr., and leave the boiler at 500 degrees, then the heat absorbed by the boiler has lowered the temperature 1,250 degrees. But suppose the temperature of the gases to the boiler is increased to, say 2,000 degrees, and leave the boiler at 500 degrees, then the heat absorbed by the boiler has lowered the temperature 1,500 degrees, or 250 degrees over the former case, which is an increase of 20 per cent. For this reason a

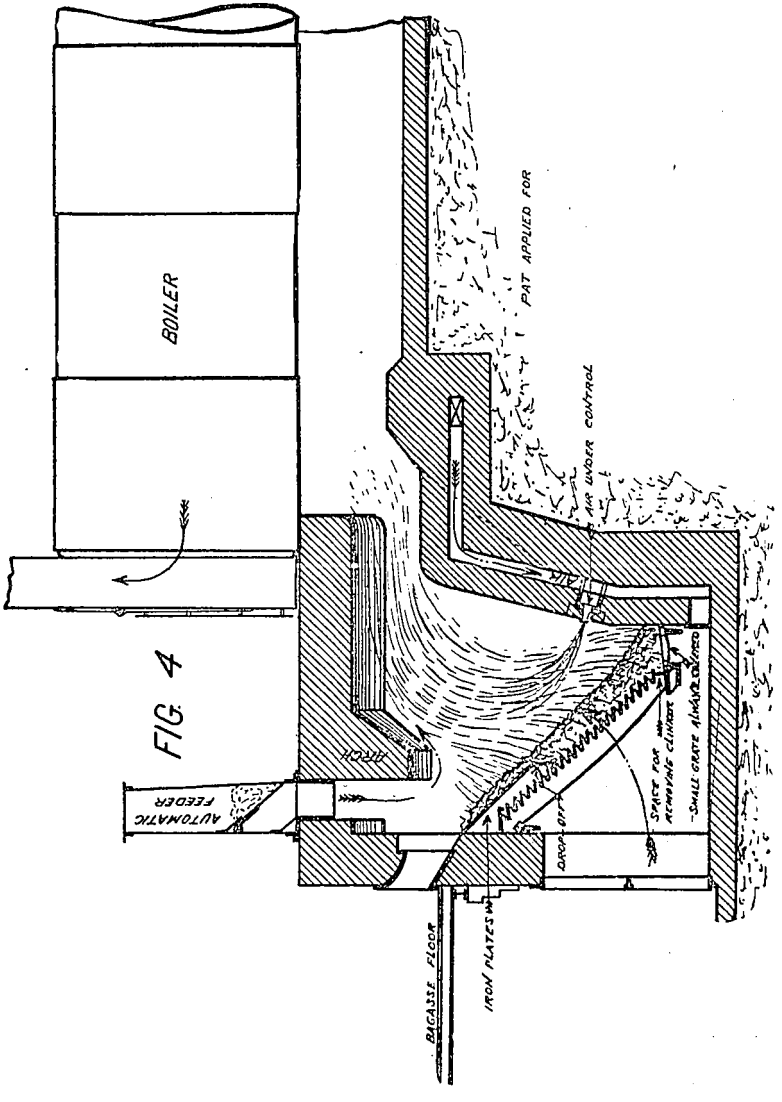
BOILER
PAT APPLIED FOR
AIR UNDER CONTROL
AUTOMATIC FEEDER
ARCH
SPACE FOR REMOVING CLINKER
SMALL GRATE ALWAYS CLOSED
BAGASSE FLOOR
IRON PLATES

FIG 4

volume of gases at a high temperature is much more efficient than a larger volume at a low temperature. The greater the difference in temperature between that of the gases and that of the boiler, the more rapidly will heat be transferred. Then for an inefficient boiler plant, it is necessary that the furnace deliver the heated gases to the boiler at as high a temperature as possible, its efficiency depending mostly upon this.

It is as necessary in burning bagasse as in burning any other fuel that there be no air-holes in the burning mass or uncovered portions of the grate. If fuel is fed on the grate so that the mass is thick in one place and thin in another, air more readily passes through the thin places on account of meeting with less resistance. The combustion in the thin places will then be the most vigorous, so that if it is not soon covered with fresh fuel, an air-hole is formed. As the air more readily passes through the holes, less passes through the fuel, thus retarding its rate of combustion. Therefore, the effect of air-holes or uncovered portions of the grate is to reduce the rate of combustion of the fuel, lower the temperature of the gases in the furnace, and increase their volume.

It is preferable to operate a bagasse furnace with a thick bed of fuel for many reasons. It is less difficult to prevent air-holes or uncovered portions of the grate, and also permits of the proper distillation of the volatiles. With a thick bed of fuel it is probable that most of the oxygen in the air will be combined before passing through the fuel, but myriads of particles of carbon will be swept through with volatiles and steam, appearing as flame. The combustibles, however, can be mixed with air introduced over the grate, and their combustion effected. From the foregoing there must exist a thickness of fuel where no surplus air will pass through, and no air will be necessary above the grate. To obtain this condition in practice, however, is impossible, so that the proper way is to have a thick bed of fuel and meet the rising combustibles with air above the grate.

The force of the draft in a furnace is an important factor in its efficient operation. The draft furnished by a tall chimney such as we have in most modern mills is ample for obtaining an intense heat in our types of furnaces when burning any quality of bagasse. The quality of the bagasse being burnt requires more or less draft. Bagasse from green cane burns more slowly than bagasse from ripe cane; therefore, in reality it requires more grate surface. In other words, the weight of bagasse from green cane that can be burnt per square foot of grate surface in a given time and with a fixed draft, is less than that which can be burnt of bagasse from ripe cane. The same is true of the different kinds of coal. This would suggest that a variable grate be made so that the

area could be changed to suit the quality of the bagasse. It would be a difficult matter in practice, so that it is customary to control the rate of combustion of the fuel by regulating the force of the draft. This is usually accomplished by partly closing the ash-pit doors. Where the quality of the bagasse does not vary much, the area of the grate should be such that the amount of fuel required to do the work will spread on the grates in a moderately thick layer and that all the available draft be employed. The grate surface in all cases should be proportioned to suit the cooling surfaces of the boiler. If the grate surface is too large and a strong draft applied, too much fuel will be consumed to generate the heat that can be absorbed by the boiler efficiently. This condition of too much grate surface exists in many of our present furnaces, but the excessive amount of fuel burnt per square foot of grate is prevented by shutting off the draft. The result is a lower temperature than could be obtained in the furnace with all the available draft, and incomplete combustion. In some cases combustion of the gases occurs in the smoke-flues or chimney after they have passed through the boilers. If the bagasse is not fed properly or piles on the top grate bars, so that it has to be pushed down by hand, the draft has to be choked, or a great drop in evaporation will occur from surplus cold air. The cause of the improper feed in this case should be remedied. Up to a certain limit of draft, provided all conditions are proper, the heat in the furnace will be intense. From excessive draft, mechanical difficulties would arise, such as blowing the bagasse from the grate. Too little draft causes a smouldering fire and great losses.

Mechanical draft and special grate bars have often been advocated. When installed, all that has been done is to reduce the grate area, operate with a thick fire and intensify the draft. If we find it necessary to choke off the chimney draft in our furnaces, we certainly do not need a blower or mechanical draft. All that is required is to cut off the grate area, and apply all the available chimney draft, by regulating the damper or by leaving the ash-pit doors wide open. If mechanical draft is insisted upon, then the induced system of mechanical draft is far more efficient and convenient of operation than that of the forced system. Also there is no better grate than the step-ladder type for burning bagasse by either system. Any other combination of grates is a source of trouble.

Does the modern furnace shown in Fig. 3 fulfill all the conditions that are necessary for obtaining the highest efficiency? In my opinion it does not, and I will try to give my reasons for such a conclusion. A horizontal grate at the lowest portion of the furnace is desirable for removing the ashes and clinkers. It also allows the bagasse rolling down the in-

clined grate to spread over and terminate on a grate at the bottom. The horizontal grates are usually about two feet long, and while proper for hand firing, they are too long for an automatically fed furnace that is working properly. The rear twelve inches of this grate will seldom be covered, for you can see from Fig. 3 that the bagasse creeping down cannot spread over the whole area of the grate. To insure that the grate with an automatically fed furnace is always covered, it should not be made over 15 inches long.

I will show later on why some engineers desire this grate to be long. A good indication of too much grate is when a furnace is operating with the draft partly shut off, for reasons previously stated. It is either a case of the boiler too small to absorb all the heat that could be generated, or the grate is too large to suit the boiler. It is invariably too much grate surface. In reducing grate area a most convenient way is to reduce it from the top where dead grate sometimes exists. This can be done with iron plates as shown in Fig. 4. These plates answer the purpose very well, are cheap, and may be easily renewed when worn. The plates can also be changed in a short time, and by putting on longer or shorter ones, the grate surface can be altered. The angle of the plates is such that the bagasse fed onto it can easily slide down. As the bagasse is on this plate a few moments, the drying process begins before it passes to the grate. This plate is also elevated for the purpose of feeding the bagasse over the top of the burning mass, and not causing the whole mass to creep down over the step-ladder bars.

As I have previously stated that the condition of highest efficiency is to surround the mass with heating surfaces, the furnace shown in Fig. 3 does not confine the mass as well as it can be accompished. As air leaks through the feeder, the opening shown in Fig. 3 allows it to pass along the ceiling of the arch to the boiler. The volatiles and moisture rising from the green bagasse join the cold air that is entering, making this a comparatively cool place in the furnace. To insure that these gases and air are thoroughly mixed and heated, it is advisable to build an arch as shown in Fig. 4. This arch will become intensely hot, and protect the front wall from the heat of the furnace. It also causes the air entering the feeder mouth to pass downward and mingle with the volatiles and moisture rising from the green bagasse, and will heat them intensely. The rear wall shown in Fig. 3 slants backward rapidly, permitting the direct passage of the gases from the grate to the bridge wall, and does not confine them. The rear wall terminating in the bridge wall should be carried up and slightly leaning backward, as shown in Fig. 4, so as to more completely surround the hot gases and bring them more intimately together before leaving the fur-

nace, thus meeting the condition necessary to obtain the highest temperature.

It is customary to allow air from the ash-pit to pass up through pipes or passages and discharge high above the grates. Some furnaces take air from the ash-pit and deliver it back of the bridge wall. Some do not make any special provisions for admitting air above the grate, but allow it to pass through the excess of horizontal grate. Some even make these bars longer to obtain this result. In all these cases the air through the uncovered portion of the horizontal grate is not controllable independent of the air passing through the bed of fuel. As it is a common occurrence to see flames extending to the rear of the boiler, it is thought by some that by bringing air in contact with them, that combustion will be completed, or partly so. Such is seldom the case, however, as their temperature is invariably too low to permit of combustion, so that air in this case is a detriment. If combustion is not completed within the furnace, it is probable that it will not be accomplished thereafter. The proper place to introduce air above the grate is as soon as possible after the combustibles rise from the bed of fuel, as shown in Fig. 4. This air should be previously heated if possible, and sent in at right angles to the gases rising from all parts of the fuel to insure that all the gases are thoroughly mixed. It is necessary to have control of this air supply, independent of that under the grate, in order to regulate the amount necessary to suit the variations in the quality of the bagasse and the rate of combustion. All other air, not passing through fuel on the grate, should be shut off as much as possible.

By the readjustment of the proportions of the furnace shown in Fig. 3 and additions that I have mentioned, the furnace shown in Fig. 4 fulfills all the conditions necessary for high efficiency. Having the fuel well confined between hot walls, the proper area of grate to suit the boiler and draft conditions, the gases at high temperatures, absolute control of the air under and above the grates, little more can be done to obtain complete combustion or increase the efficiency of our present type of furnace. As the boiler is often accused when the fault lies in the furnace, by delivering to them gases at high temperatures and at less velocity, their surfaces will become more efficient.

CONTRACT LABOR IN HAWAIIAN ISLANDS.

By Katharine Coman.

(Continued from October No., Page 446.)

It was the desire to promote immigration, while avoiding the evils of the coolie trade, that suggested the Bureau of Immigration. Kamehameha V said in an address from the throne in 1867: "Our agricultural enterprises have been urged forward with such energy on every island of the group as to render the importation of laborers necessary. I am of the opinion that the government is the proper agent to carry out such a measure and that means ought to be placed at its disposal to undertake it promptly. The wants of our agriculture, the dictates of humanity and the preservation of our race demand that the government should control this action." In accordance with the king's recommendation, a committee of the Privy Council was constituted the Board of Immigration and instructed to submit "such measures as may be necessary to secure the importation of a sufficient number of foreign laborers to supply the wants of planters and others" and to devise "such regulations as may be deemed expedent, touching the contracts to be made with such laborers, as well as the terms and conditions upon which they are to be assigned after their arrival in this kingdom." The recommendations of the Board when approved by the Privy Council were to have the force of laws.

The principle of state regulation once established, an agitation was set on foot for the reform of the labor system, and various amendments of the Master and Servants Act were proposed. In 1872 the reform element secured a majority vote in the legislature, and a thorough revision of the terms of the labor contract resulted. For the protection of parties to contracts authorized by section 1417 of the civil code, a law was passed providing that every contract for service must be acknowledged by both master and servant before an authorized officer of the government. The certificate of acknowledgment should state that after the contract had been read and explained to the parties, "they severally acknowledged that they understood the same and that they had executed the same voluntarily." An agent or recorder for each district was provided who was directed to cause money advanced to the servant to be paid in his presence and to keep an accurate record of contracts acknowledged before him, "which record shall set forth the names and residence of the parties, the date and term of the contract, the amount of advance paid and the wages stipulated for."

The distinction between contract labor and serf labor was clearly made. The laborer was not bound to the plantation. The contract established a personal bond and ceased to be operative on the death of the master or in case the plantation changed hands. This principle was later affirmed by decisions of the Supreme Court.[1]

Transfers of contract from one employer to another were not permitted until the convention with Japan (1886). Such transfers, in the case of Japanese laborers and Chinese under the restrictive law of 1892, were allowed only with the consent of the employer and laborer concerned and with the approval of the Board of Immigration. A laborer might commute any portion of his term of service by making over to his employer the just proportion of the sum advanced for his transportation expenses.

The extension of the term of service was carefully guarded against abuse. "No contract laborer may be compelled to work beyond the term of his contract in liquidation of a debt entered into during such term." Any contract stipulations to this effect were declared void. "In all cases when any person under contract to serve another shall be sentenced by any court to make to his master satisfaction for loss of time by desertion by working for a period of time beyond that contracted for, he shall be paid his wages for such extra time worked at the rate stipulated for in the contract." By an amendment of 1882, the extension of the labor term as punishment for desertion was prohibited. The recovered servant might be compelled to serve to the end of his original term and no more. A contract laborer escaping from service might be fined five dollars for the first offense and ten dollars for each subsequent offense, and in default of payment should be confined at hard labor until fine and costs were paid. When he had met the prescribed penalty he was to be restored to his master to serve for the remainder of his original term.

In case of ill-usage the servant might secure redress from the courts as under the laws of colonial Virginia.[1]

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1. 1887. J. Nott vs. Kanahele. "This is a personal contract and the laborer is not bound to the land as a serf."

1889. C. Afong vs. Kale. An application for release from contract on the ground that the laborer had been made to work on a schooner instead of on a sugar plantation was not allowed.

2. "Whereas, the Barbarous usage of some servants by cruel Masters, brings so much Scandal and Infamy to the Country in general, that people who would willingly adventure themselves hither, are through fear thereof diverted, and by that means the supplies of particular men and the well seating of his Majestie's country very much obstructed: Be it therefore enacted, that every master shall provide for his servants competent Diet, Clothing and Lodging, and that he shall not exceed the

A law of 1876 prescribed that in all contracts where the length of a day's labor was not specified, nine hours should constitute a working day. The laborer was entitled to extra compensation for work in excess of such time. A law of 1884 further guarded the laborer's interests: "Whereas laborers serving under written contracts are sometimes oppressed through having their wages excessively reduced for lost time, every laborer serving under written contract shall be entitled to his full pay under the contract, according to the time he has worked, and no master shall deduct from the wages of any such laborer for lost time, more than the amount of money representing such lost time."

A law of 1880 fixed a sanitary standard for plantation "camps." A tenement for contract laborers must be built eighteen inches from the ground with a water-tight roof and must provide three hundred cubic feet of air space for each adult lodger, and three hundred for two children; the house must be kept in good repair and white-washed frequently; the yard must be well-drained and free from rubbish; a cess-pool must be provided for every six adults. The penalty for non-compliance with any one of these requirements was fifty dollars. The officers of the board of health were to have free access to the laborers' quarters. The Board of Immigration had full power to direct the course of immigration and to determine from what source the "foreign laborers" should be derived. By the king's ordinance of 1865, private persons were prohibited from introducing bound laborers into the kingdom without the express license of the Board of Immi-

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bounds of moderation in correcting them beyond the merit of their offenses; and that it shall be lawful for any Servant, giving notice to their Masters, having just cause of complaint against them, for harsh and bad usage, or else for want of Diet and convenient Necessaries; to repair to the next commissioner to make his or their complaint; and if the said commissioner shall find by just proof that the said servants' cause of complaint is just, the said commissioner is hereby required to give order for the Warning of such Master to the next County Court, where the matter in difference shall be determined, and the servant have remedy for his grievance." Collection of the laws of Virginia, 1162, Chap. 103. "If any master shall be guilty of any cruelty, misusage or violation of any of the terms of the contract, toward any person bound to service under the 1417th or 1418th sections (of the Civil Code), such person may make complaint to any District or Police Justice, who shall summon the parties before him, examine into, hear and determine the complaint and in all such examinations the complainant shall be a competent witness; and if the complaint shall be sustained, such person shall be discharged from all obligations of service and the master shall be fined in a sum not less than $5, nor more than $100, and in default of the payment thereof be imprisoned at hard labor till the sum is paid."

Ruling of the Supreme Court, 1853. The King vs. In re Greenwell: "The whipping of servants or laborers is not justifiable under the laws of this Kingdom. A master may correct his apprentice with due moderation."

gration. Heavy penalties were imposed for evasion of this prohibition. Planters were fined $800 and ship-masters $100, for each offense.

The immigration system so regulated, compares favorably with the coolie trade in its best estate as practiced in British Guiana under the Consolidated Immigration Ordinances of 1864 and 1891. The work of the Bureau of Immigration in prescribing the number of laborers to be imported, the countries from which they might be drawn, the vessels in which they might be carried, the accommodations that must be afforded them at sea and in port, the terms of the contracts to be made with them, and the living and working conditions on the plantations to which they were assigned, is closely analogous to that of the immigration agent general of British Guiana and his staff of deputies, clerks and physicians. The Bureau of Immigration sent inspectors on a circuit of the plantations four times a year to make sure that the laborers' dwellings were kept up to the required sanitary standard, and that sufficient medical care was provided. The inspectors were further empowered to investigate all complaints, to settle disputes wherever possible and to arrange for commutations and transfers of service. Biennial reports were made to the legislative assembly (printed 1882-1899) in which the policy of the Board was set forth and recommendations for improving upon the immigration system submitted. After 1886, a detailed report on the sixty odd plantations was incorporated, stating the number and nationality of laborers and the sanitary conditions for each, and reporting breaches of the law, maltreatment of laborers, etc.[1] It is worthy of remark that the provisions for the well-being of the laborer which were imposed upon the planters and the government of Guiana by Parliament and the Colonial Office, were adopted by a representative legislature in Hawaii in the interest of the public good.

There are three points of advantage in favor of the Indian coolie. First, the system of recruiting in India is under the supervision of the protector of immigrants in Calcutta. The Bureau of Immigration maintained an authorized recruiting agent at Madeira, at Hongkong, and at Yokohama and specified the vessels of steamship lines by which immigrants might be transported. It could not in the nature of things go further. Second, the wages of the laborers transported to British Guiana were not fixed in advance, and the indenture when made out at Georgetown bound the coolie to serve a given

3. In the report for 1897, *c. g.*, there is an account of a riot which had occurred on Lihue plantation, Kauai. The inspector investigated, the head luna was discharged and the manager reprimanded and told that he would be held to strict account for the better treatment of his laborers in future.

master for five years without stipulated wages. The law provided that the remuneration of the coolie might not be less than that of the free laborer and that the task assigned him might not be heavier. The practice of leaving the compensation of the imported laborer to be determined by the conditions of the free labor market threw upon him the responsibility of determining his wage-rate—a responsibility to which he, a stranger and a bondsman, was hardly adequate. The legal minimum was fixed at a shilling a day for five days work a week. The average earnings of a good workman were estimated at two shillings. The earnings of the Portuguese contract laborer who, in 1877, was guaranteed by the Board of Immigration ten dollars a month with fuel, lodging and food were considerably better. Third, the Hindoo coolie who, at the end of his five years, was re-indentured for a second five year term was given a bounty of fifty dollars, amounting to the cost of return passage. The laborer was more valuable in his second term than in the first because he had become thoroughly acclimatized, familiar with plantation life, and a skilled workman. The Hawaiian government offered no such inducement, but the laborers not unfrequently re-engaged for a second and even a third term, steady employment at advanced wages proving a sufficient inducement. Experienced laborers, whether free or under contract, commanded higher wages.

In the report of 1888-1890, the Board of Immigration estimated plantation wages as follows:

	Contract Laborers.	Free Laborers.
Hawaiian	$18.58 per month.	$20.64 per month.
Portuguese	19.53 "	22.25 "
Japanese	15.58 "	18.84 "
Chinese	17.61 "	17.47 "
South Sea Islander	15.81 "	18.56 "

The figures show a high average wage in case of the free laborer, but the majority of contract laborers were serving for the first term or were inferior men who could find employment only under contract and at low wages.

Any impartial study of the proceedings of the Board will disclose a persistent and sustained effort to secure immigrants who would be desirable not only as laborers but as citizens. The initial attempt to bring in natives of the South Sea islands, men and women, has already been recited. The hope of thus renewing the aboriginal race was not abandoned, though the people thus introduced were for the most part discouraging material both as laborers and as citizens. As late as 1883 a shipment of thirty South Sea Islanders is recorded. In the twenty years from 1865 to 1885, 2448 Polyne-

sians were brought into the Hawaiian Islands. A bare six hundred remain, only forty-six being plantation laborers. Plans were early set on foot for inducing free immigration from the Azores, the Canary, and the Cape Verde Islands. The impoverished state of these Portuguese settlements, after the failure of their vineyards, gave reason to hope that the superfluous population might be drawn to a land where demand for labor was in excess of supply; but it soon became evident that the Portuguese would not undertake the long journey to an unknown country without artificial stimulus. Reverting to the Orient, the Board in 1865 commissioned Dr. Hillebrand, a man of scientific attainments, to make a tour of China, Japan, Malaysia, and India with a view to studying the labor possibilities of these over-populated regions and making recommendations that might serve as a basis for a systematic scheme of immigration.

But the theories and aspirations of the Board and of such doctrinaires as Gibson were continually held in check by the incessant demand of the planters for an immediate supply of laborers. Again and again the exigencies of the sugar crop proved a more potent argument than any hypothesis as to the ultimate good of the state. The immediate necessity could best be met by the importation of Chinese coolies. The immigration table shows conclusively that the stream of Chinese immigration received no perceptible check from the establishment of the Board. Ten years earlier Prince Liholiho, in an address before the Hawaiian Agricultural Society, had put the matter in a nut-shell: "Chinese have been introduced here, and more are on their way hither. With all their faults and a considerable disposition to hang themselves, they have been found very useful. Suffice it to say that some of our largest sugar and coffee plantations are now chiefly dependent upon them for the principal amount of labor done. That they might be better than they are ought not to be used as an argument against them. That they are procurable, that they have been procured, that their wages are reasonable, that you can calculate on retaining them for a certain term, that the climate suits them and that they are handy in the house and in fields are great facts. Excepting what relates to these coolies, all that bears upon the subject of imported labor, is just theory and speculation."

Forced to fall back upon China, the Board of Immigration directed its attention to improving the conditions of the coolie trade and to securing a class of immigrants that might prove less harmful to the social interests of the islands. Dr. Hillebrand's first step was to arrange for the transportation of five hundred Chinese laborers. Reliable recruiting agents were selected, and Rev. Mr. Lobscheid, formerly a missionary in Hongkong, was made responsible for the physical well-being of the immigrants. Twenty-five per cent of the people

were to be women, and they were shipped in two commodious vessels as a precaution against disease. The horrors of the coolie trade as carried on by the Portuguese at Macao called forth a vigorous denunciation from the good Doctor.[1]

The Chinese were entirely satisfactory as laborers, but they were regarded with little favor by the Hawaiians and by the artisan class who did not look upon the sugar industry as the corner-stone of the state. Their vigorous protests induced the Board to try another experiment. Negotiations were opened through the Hawaiian consul in Japan for the introduction of laborers from that kingdom. The Japanese government furthered the project, and in 1868 one hundred and forty-eight immigrants were secured. They were under contract for three years' service at four dollars per month for men and three dollars per month for women. Two Japanese head-men were provided for each gang of twenty-five laborers, and were paid one dollar per month additional. A head-man for the whole company was paid $150 a year, with living expenses, for his services as interpreter and mediator. All complaints were to be laid before the Board and there adjudicated. The system of fines for minor offenses, in vogue on some plantations, was abolished so far as these laborers were concerned. All cost of transportation was met by the employers, and food, lodging, and medicine were to be provided free. The experiment might have been a permanent success but for misunderstandings due to the ignorance of the interpreters. The Japanese government becoming alarmed for the safety of the people, sent a commission of inquiry to Hawaii. The commissioners reported, "We have everywhere found our countrymen well cared for and kindly treated by their employers." Notwithstanding, the Japanese authorities refused,

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4. The cost of importing one of these laborers was as follows:

Recruiting, lodging in Hongkong, two suits clothes, provisions for voyage	$25
Passage money	12
Commission	4
Board expenses	10
Medical attendance	4
Bonus paid to men	8
Bonus paid to women	20

The expenses of transportation ($60) were met by the planter who engaged the laborer's services, but all except the bonus and the Board expenses were treated as an advance and deducted from wages month by month. Thus the final cost of this labor was less than that of the Chinese first imported, but even so there was no difficulty in securing them. With wages at $4 per month and $2 as a New Year's gift, the coolie earned in three years $150 in addition to the bonus of $8. After having made good the advance payment ($42) he would have earned $116. Since all living expenses, food, shelter, fuel and clothing were provided him, the bulk of this sum was clear gain.

for the time being, to consider any further propositions for immigration under labor contract.

The reformed immigration system was hardly in full operation when the Reciprocity Treaty with the United States gave a marked stimulus to sugar culture and produced an even more insistent demand for labor. To meet this emergency, the Board commissioned Dr. Hillebrand, then residing in the Azores, to arrange for the transportation of Portuguese laborers. The terms offered in the contracts of 1877 were most generous.[1]

Passage money was to be prepaid and refunded to the planter only in case the laborer withdrew from his contract before the expiration of the three years' term, and then proportion to the amount of service unperformed. Employment was guaranteed by the Board at the rate of $10 for men, $6 to $8 for women, with food, lodging and medical attendance provided. A day's ration was to consist of one pound of beef or one-half pound of fish, fresh or salt as might be best obtained, one and one-half pounds of rice, one-half pound of taro or other vegetable, one-third ounce of tea. Garden ground was to be supplied in immediate connection with the house. The greater cost of this labor was made good by the superior efficiency of Europeans. Recruiting agents in the Azores were thus instructed by the Board: "We are particularly

5. Labor Contract of 1885: "This agreement, entered into between Augusto da Silva Moreira and Hoffnung, agent of the Board of Immigration, Witnesseth:—That whereas the party of the second part is desirous of emigrating to the Hawaiian Islands, there to be employed as an agricultural laborer, under the direction of the Board of Immigration: Now, therefore, in consideration of a passage to the Hawaiian Islands on board the steamship Hausa and a further undertaking by the party of the first part that the said Board of Immigration will pay or cause to be paid, to the party of the second part, wages at the rate of $9 per month, with board and lodging for himself and children under twelve years of age, for each and every month of 26 days' service faithfully performed during the existence of this agreement (a day's service to be ten hours in the field and twelve hours in the sugar-house); such wages to be paid at the end of each calendar month, reckoning from the date of the commencement of such service after arrival at Honolulu,—and in consideration of a further undertaking on the part of the party of the first part to secure the party of the second part full protection under the Hawaiian law, as fully as the same is enjoyed by the native born subjects of the kingdom, and likewise in case of sickness that he shall be supplied with proper medical attendance and that the said children shall be properly instructed in the native schools, the said party of the second part will duly and faithfully perform such lawful and proper labor as he may be directed to perform under the auspices of the said Board of Immigration for the term of three years, counting from the day on which he shall commence such service after arrival in the kingdom of Hawaii, it being always understood that the contracted party shall not work on Sunday or on any holiday recognized by the government, and that his services shall not be transferred without his consent."

desirous that no underhand or unjust means of any kind be used in inducing these people to emigrate. All that come shall be well used. Every promise made in the contracts shall be faithfully carried out." The Board made good its assurances by promptly investigating complaints as to insufficient food and medical attendance on the voyage. It was made evident that there was no more sickness among the passengers than was inevitable to the long voyage around the Horn.

The arrival of the first Portuguese was an event of critical importance to the industrial and social future of the Islands. There were eighty men, forty women and sixty children. The Portuguese consul at Honolulu, Mr. Perry, supervised the signing of their contracts, allowing them full liberty to choose their employers. In accordance with the instructions of the Board, families were not separated in the assignment of laborers. The planters expressed themselves as so well content with this experiment that steps were taken to place Portuguese immigration on a permanent basis. Mr. Hutcheson was appointed Hawaiian consul at Madeira with a view to facilitating the recruiting of immigrants, while Hoffnung and Co., ship-masters of London, were comissioned to transport from one thousand to ten thousand people at ninety dollars per capita. The cost of transportation was to be refunded by the men. Half the passage of women and the entire passage of children would be met by the Board. The proportion of women was to be from thirty-five to forty per cent. Children were allowed at the rate of two to a family. The announcement that twelve hundred Portuguese were on the way to the Islands gave general satisfaction.

Comic, therefore, was the dismay of the Board when the Ravenscrag arrived with one hundred and thirty-three men, one hundred and ten women and one hundred and seventy-six children. Later shipments were even more unprofitable from the planters' point of view. The Portuguese persisted in bringing their families, male and female, young and old, till the Board was forced to make a new arrangement. The planter's share of the cost of transporting the women was to be paid in monthly deductions from the wages of the men and women concerned. Children from twelve to thirteen years might be contracted to labor at four dollars per month, children from thirteen to fourteen years at five dollars, from fourteen to fifteen years at six dollars per month. Passage money for children under twelve years was still to be met by the Board. The heavy expenditures of the government on this account could only be made good in the course of years when these unwelcome children became tax-paying citizens.

From the beginning the governor of Madeira had made difficulty about the labor contracts, sometimes annulling them outright so that the men arrived under no further obligation than to repay the cost of their transportation, an obligation

easily shirked. In 1881 H. A. P. Carter was sent to Lisbon as minister plenipotentiary for the purpose of placing the emigration of laborers from the Western Islands to Hawaii on a treaty basis. He succeeded in negotiating a convention between Portugal and the Hawaiian Islands in which it was agreed: 1. That contracts for service were to be binding on both parties; 2. That adequate protection was to be afforded the immigrants under the Hawaiian law; 3. That immigrant ships should conform to specified requirements in regard to space, quantity and quality of food, medicine, sanitation, etc.

The shipments of the next three years amounted to seven thousand seven hundred, yet the laborers commanded better and better wages. In 1884, the Board was constrained to offer sixteen dollars a month with lodging and fuel but without food, with the further promise of an allowance of two dollars a month for one child and four dollars for two or more. This unlooked for surrender of a long contested point was occasioned by the dread signs of exhaustion in this much prized labor supply. In 1884, Hoffnung wrote: "Our agent at St. Michaels finds it less easy to recruit emigrants from that island from which we have already taken some six thousand or seven thousand souls. He informs us that all wages have recently been doubled and there are other signs that the surplus population has been disposed of. Moreover the Brazilian and other governments are now offering special inducements to emigrants for their respective countries, and the competition is carrying off a good many to other fields of labor whom we had anticipated being able to engage for the Hawaiian Islands." The warning was quickly fulfilled, shipments of Portuguese dwindled to 278 in 1885, and ceased altogether after 1888. Of the fourteen thousand Portuguese brought to the Hawaiian Islands, few returned to their native land; but, to the disappointment of the planters, very few were willing to renew their labor contracts at the expiration of the original term. They preferred to rent a bit of land and cultivate on their own account. The planter's loss was the gain of the state. The Portuguese are today the small farmer class and the backbone of the coffee industry.

Other sources of supply had already been attempted. The ever resourceful Gibson had proposed (1868) to secure Malaysians from the overpopulated islands of the Orient. Objections on the part of the Dutch government thwarted this enterprise, but for years to come the hope that from Java and Sumatra might be derived a population akin to the Hawaiian and capable of restoring that decaying race, hovered on the horizon as a vision that might readily be realized. W. N. Armstrong, who accompanied Kalakaua on his journey round the world in 1881, was commissioned to study the labor possibilities of the countries visited. He once and for all dispelled the Malay mirage by calling attention to the fact that the

Malaysians were not the labor reliance of the lands where they dwelt, and that the Dutch government had been obliged to allow the importation of Chinese coolies. The reciprocity year saw H. A. P. Carter sent to England to negotiate for the importation of East Indians as contract laborers. This hopeful project was disapproved from the start by the East Indian authorities, who successfully blocked negotiations. Persistent inquiry demonstrated that the British government would consent to no scheme of emigration that did not provide for a first-hand supervision of the laborers by protectors responsible to the Colonial Office. This proviso effectually disposed of all hope of Hindoo labor. A proposition to import negroes from the southern states or from Kansas was considered by the Board in 1880, and General Armstrong of the Hampton Institute was requested to report upon its feasibility. The actual investigation and report was made by W. N. Armstrong, because General Armstrong was too much occupied to undertake it. The report was discouraging. The cost of transportation would be great, and it was believed that the negro would be quite unwilling to enter into any labor contract that might be penally enforced. The proposition was finally set aside by a resolution of the Hawaiian Legislature disapproving the introduction of negro laborers.

Some of the more public-spirited planters now turned their attention to Europe as a possible recruiting ground. In the lands where the climate was severe and nature provided but a sparse subsistence, surely men might be found willing, may glad, to migrate to the "Paraside of the Pacific." One hundred and twenty-four Germans, men, women, and children, were imported as contract laborers in 1880. They proved highly satisfactory as laborers and as citizens, but they did not long remain agriculturists. After serving out his three years' term, a German readily found a position as *luna*, or made his way into a trade. It was not easy to secure further shipments. The trend of emigration from Germany was to the United States where land might be had on easy terms. Not more than fifteen hundred Germans in all engaged for contract labor in Hawaii.

In the same year Castle and Cooke, enterprising merchants of Honolulu, obtained permission to import Scandinavians under labor contracts. The Board agreed to pay half passage for the women brought in and full passage for children. Five hundred and fifty immigrants were the result of this venture. They were readily placed on plantations, but hardly were they domiciled than furious protests were sent in to the Board and to the home government against the rations and quarters provided. The complaints showed a complete ignorance of the new living conditions. For example, the lack of butter and potatoes was regarded as a hardship. Butter and Irish potatoes were imported from San Francisco and were luxuries

reserved to the tables of the rich. Further, the cottages were thought uninhabitable because between the roof and the siding was an interval of several inches. This means of ventilation is necessary to health in a plantation camp in Hawaii. The charges were promptly investigated by the Board and by a commissioner sent out by the Swedish government. The commissioner unhesitatingly pronounced the accusations frivolous and said that the people were faring far better than in the homes from which they came. They had been hastily recruited in the seaports and had no liking for agricultural labor. Their real grievance was that they were under contract to work for twenty dollars a month when they might have been earning from two to four dollars a day at various trades. Some of these laborers, absconding, carried their complaints to America and found there a more sympathetic audience. The San Francisco Chronicle in June, 1881, published a sensational article on the "modern slavery" permitted in the Sandwich Islands. English and German papers copied the statements, and a new horror was exploited by the European press. A vigorous refutation was drawn up and signed by one hundred and six German residents in the Islands. "Personal freedom is, thanks to a well-regulated legislation, as secure here as in those countries which claim the highest civilization, and the legal decrees concerning the relation between employer and working-man are entirely just and founded on those now in existence in the United States of America."

Meantime the importation of Chinese coolies went on apace. Laborers were always to be had in unlimited quantity and on easy terms from that swarming hive of men. In 1875, the legislature had attached a rider to the appropriation for the encouragement of agriculture and immigration, stipulating that no part of the sum should be used for the transportation of Chinese, excepting the bonus on women imported. But coolies continued to be brought in by private parties with the more or less reluctant consent of the Board of Immigration. The number rose from 62 in 1875, to 3,652 in 1880 and 4,295 in 1884. By 1886 the Chinese in the Islands numbered twenty thousand, one-fourth of the total population, but only 5,605 of these were plantation laborers. The emancipated coolies found their way into various trades. Some were small shop-keepers, some had rented land and were cultivating rice and vegetables, many were earning good wages at diverse skilled trades. Serious as were the objections to the Chinese on moral grounds, they were highly satisfactory as workmen, —peaceable, intelligent and reliable. Moreover, they cost less than the other laborers available. The initial cost of transportation was considerably less than for European laborers, and John Chinaman had no women and children to be provided for.

Public sentiment finally over-mastered the wishes of the planters. Agitation against the importation of Chinese was strong in the early eighties. Public-spirited Hawaiians protested against their vices, as a corrupting element in the body politic. Artisans complained that their competition was lowering wages and the standard of living. But the menace to public health involved in importing shiploads of Orientals was perhaps the argument that told most heavily against them. In 1881 the Septima arrived at Honolulu with six hundred and ninety-nine Chinamen aboard and six cases of smallpox. The passengers were detained in quarantine, the sick being removed, until all danger of further outbreak had passed. Soon after these men had been placed on plantations several other tramp steamers arrived in similar plight. The ordinary quarantine accommodations proved entirely inadequate, and the suspects were housed in make-shift quarters with a guard to prevent their escape. Complaints were forwarded to the Chinese Minister at Washington alleging that the coolies had been confined within a stockade guarded by soldiers and so forced to sign contracts prejudicial to their interests. The old scandals concerning slavery in Hawaii were revived, much to the chagrin of all patriotic citizens.

In 1883 the first legislative restriction on the importation of Chinese was imposed. No more than six hundred were to be admitted in any consecutive three months, and they were to be transported in no vessels but those of the two regular lines, the Pacific Mail and the Oriental and Occidental. These restrictions were resented by the planters and a protest was addressed to the minister of the interior by the Planters' Association on August 27, 1884.

The petition of the undersigned planters and other employers of labor respectfully represents that their several business enterprises are suffering in consequence of the scarcity of suitable laborers to perform the necessary work which their several business enterprises require and demand. And by reason of the scarcity of laborers, wages for unskilled labor, field hands, etc., are so high that the planters and other employers, under existing adverse circumstances, cannot afford to pay the ruling rate of wages, and consequent disaster threatens their several enterprises.

And as the Chinese are acknowledged to be the best and most economical laborers in the kingdom for general plantation and other work, and knowing that additional numbers of Chinese in the Kingdom would materially relieve the existing difficulties:

Therefore, your petitioners pray that it may please Your Excellency, to encourage, and, as far as possible, provide for and allow a further and free immigration of Chinese from China and elsewhere into this Kingdom, to the number of 500 adult men per month, until all demands of labor shall be fully supplied.

The intention of this petition is not to interfere with or check the immigration of Portuguese, Japanese or others, which people can be employed at other and higher classes of work, and thereby earn the higher rates of wages paid them.

A struggle between the planters and the press ensued, the former representing the industrial and the latter the social interests of the Islands. Mindful of the fact that the prosperity of the sugar plantations was fundamental to the prosperity of all other business, the government provided against an actual shortage of labor by negotiating for a liberal importation of Japanese. Three thousand contract laborers were imported and a labor convention with Japan concluded, in anticipation of more drastic legislation against the Chinese. The decade from 1885 to 1895 saw no less than four enactments on the vexed question of Chinese immigration. A law of 1885 prohibited any shipmaster from bringing in more than twenty-five Chinese who could not show pass-ports proving previous residence in the Hawaiian Islands. In 1886 was passed an exclusion act quite as rigid as the Geary Law. "No Chinese passenger shall be allowed to land at any port in the Hawaiian Kingdom unless such passenger be the bearer of a pass-port" proving previous residence. The only exceptions allowed were merchants for a limited term, wives and children of resident Chinese, officials representing the Chinese government, teachers and ministers of the gospel.

(To be continued.)

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SUGAR IN FRANCE.

Beginning today in France, sugar which has heretofore sold for 1.10 francs (21.23 cents) per kilogram (2.2046 pounds) will be sold for 70 to 75 centimes (13.51 to 14.475 cents). This reduction is due to a lowering of the internal-revenue tax from 64 francs to 25 francs ($12.352 to $4.825) per 100 kilograms (220.46 pounds), a result of the Brussels conference, wherein the agreement was made by France, Germany, Austria, Hungary, Belgium, Spain, England, Italy, the Netherlands, and Sweden to suppress all direct and indirect premiums accorded sugar exporters, thus reducing by nearly $10,000,000 the annual income of the French sugar industry.

Spain and Italy have built sugar factories which will probably supply their peoples in the near future. What, then, will be done with the surplus production of France, Germany, and Austria? The output of France is nearly double that of its consumption, and the Government has been busy since the object of the Brussels sugar conference threatened to become a reality to devise some means to dispose of this excess. The simplest way seemed the best—to lower the internal-revenue tax that the people might buy sugar cheaper and thus buy more, on the same basis that a reduction of postage increases the buying of stamps. England furnishes an example of this.

In 1848 in that country the internal-revenue tax amounted to $5.95 per 100 pounds, at which time the consumption per inhabitant was 25 pounds. Because of successive reductions of this tax, until 1874, when all tax was removed, the consumption of sugar doubled. To-day it has quadrupled, being 100 pounds per head. France does not hope for such results as this, as an Englishman drinks sweetened tea much after the manner a Frenchman drinks wine; but it is certain that home consumption will considerably increase. In Gers, a part of southwestern France, purely agricultural, and wherein there are no fiscal taxes, the individual consumption is exactly the same as in Switzerland—55 pounds per inhabitant.

At present in France each inhabitant consumes not quite 36.75 pounds. To consume the total production of the country this amount must be increased to 66 pounds, an increase which, if not impossible, will at least take many years to attain; during which time the sugar factories, beet-root culture, the labor employed in this industry, and the receipts from exports must all suffer their part of the burden.—Consular Reports.

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INTERNATIONAL ADJUSTMENT OF SUGAR PRODUCTION.

At a meeting of representatives of the sugar industries of various European countries, an attempt was made to come to an agreement regarding the production and export of sugar. The following resolutions were adopted:

1. It is desirable that the production of beet sugar in the various European countries for export should be restricted in order to prevent overproduction.

2. This purpose may be accomplished by an agreement between all organs qualified to represent the sugar industry in the sugar producing countries of Europe. This agreement should include refined and unrefined sugars.

3. It is necessary that all European countries exporting sugar should be unanimous in joining this agreement, especially Germany, Austria-Hungary, Belgium, France, Holland and Russia. It is also desirable that Java should join.

4. It is sufficient to fix the amount of export sugar; the adjustment of the internal relations may be left to each state.

5. The total amount required for export is to be determined on the basis of the minimum demand; a permanent committee to watch over the execution of the agreement.

6. This agreement to be valid for the same period as the Brussels convention.

7. The export should be regulated on the basis of the official statistics of the revenue and custom house authorities, ninety kilograms of refined sugar to be counted equal to one hundred kilograms of unrefined sugar.

8. The average production of sugar in the three campaigns of 1900-01, 1901-2, 1902-3, diminished by the average home consumption, is to serve as a basis for the computation of the export figures, increased by the average imports during the same period.

9. Every country should furnish guarantees for the faithful fulfillment of the agreement.

Of course, these resolutions are only suggestions and cannot be regarded as the practical outlines for the solution of the problem. Without the active help of the various governments nothing can be accomplished.—Beet Sugar Gazette.

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PHILIPPINE SUGAR.

Second in importance from the standpoint of exportation during the past year, is the sugar industry, which has suffered greatly in the general agricultural depression. While the Philippine Islands offer advantages surpassed in but few portions of the world for the culture of sugar cane, yet, from various causes the production of Philippine sugar has materially decreased during the last four years.

As in other agricultural pursuits of the islands in which the laboring class plays so prominent a role, the general scarcity of this element at the present time has had its effects on the sugar industry, while the death from rinderpest of the majority of carabaos, the principal beast of burden used in the cane fields, and the unsettled condition of affairs in the archipelago attendant on several years of devastating war, all have tended to materially reduce the production. Although cane grows in almost every island of the group, its home is just as distinctively in the Visayan Islands as that of tobacco in the north of Luzon. The island of Negros has acquired an enviable reputation for the culture of sugar, its soil being of such fertility that a crop of cane is known to have been raised annually for many years past with but little manuring. The planter, though he is holder of large tracts of land, and may employ a large number of laborers, uses the same crude methods that have characterized the preparation of his field and the planting of cane in years gone by. It is stated on good authority that the cane used in cultivation at the present time is in direct descent from that introduced many years ago, there having been no attempt to experiment with a more productive variety.

Few of the sugar plantations are equipped with modern labor-saving machinery in general use in the United States and

other countries. Again, the plantations are generally small, in but few cases exceeding as much as a thousand acres in extent, an amount of land insufficient to support a large wooden mill equipped with hundred of thousands of dollars worth of modern and expensive machinery. The labor system varies considerably in different sugar-producing provinces. In the northern provinces the co-operative plan is in general vogue. In this case the land owner divides his plantation into tenements and each tenant is provided with carabaos and the necessary agricultural implements to work the cane fields. One mill grinds the cane for the entire plantation, and in the grinding season each tenant brings his cane to the mill where it is ground separately. From one-third to one-half is usually given the tenant to pay for his labor, while the balance goes to the owner of the land. In season while the cane is maturing the owner of the land is usually compelled to make advances to his tenants on the strength of their share in the prospective crop. On advances of this nature an interest of from ten to twenty per centum is usually charged. In the daily wage system it is said that the employer is also compelled to make large advances to his Filipino laborers, who frequently demand their pay for several weeks in advance, and refuse to work unless their demands are granted.

No attempts have ever been made to manufacture the higher grades of sugar such as is exported from Java and Hawaiian Islands. It may be mentioned that the Filipino makes an excellent mechanic once properly trained, and under competent supervision a sugar estate should be run at less expense than are Hawaiian plantations.

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TREE PLANTING.

A number of States are planting trees on waste lands and forming forest reserves. In some cases the work is one of reforestation, and in others it is proposed to make trees grow in regions like the sand hills of Nebraska, which are unfit for agriculture and may be made useful as forested areas.

Indiana.—The State has purchased 2,000 acres of land in Clark county for a forest reserve. Of this tract 1,500 acres are covered with young second-growth timber of varying quality, and 500 acres are tillable. The State Forest Board will attempt to prove the profit in growing native hardwoods, and will plant oak, walnut, ash, hickory, and other suitable species, and give them careful cultivation. The entire tract will be placed in timber.

Kansas.—Secretary Hitchcock, of the Interior Department, has ordered the withdrawal of 94,732 acres of land lying just south of the Arkansas river, in Kearney, Finney, Grant and

Haskell counties, for a large experiment in forest planting similar to that made on the Nebraska forest reserves. The land will be set aside as a regular forest reserve in the usual manner, or President Roosevelt will be asked to set it aside for the direct purpose of experimental tree planting. The conditions are similar to those in Nebraska, the region being made up of wind-formed sand hills, now covered with bunch grass. There is no surface drainage and no possibility of cultivation, since the sand begins to drift as soon as it is tilled. Planting will be begun within the next year.

California.—The Bureau of Forestry has planted many acres of burned-over lands in the San Gabriel and San Bernardino Mountains in Southern California during the past winter. Heavy rains helped the planters, and the seeds of the November sowing have already germinated. This work has had the interest and co-operation of the country which it affects. The Los Angeles County Water and Forest Association contributed $266, and the Board of Trade of Pasadena $600, toward the expense of planting. The country is alarmed at a decreasing water supply, and the conserving influence of trees on the burned slopes is a vital matter. A squad of ten to fifteen men under Mr. T. P. Lukens, of Pasadena, has been planting seeds for three months. Knobcone Pine has been planted in the dry, burned spots; incense cedar and sugar pine in the moister, cooler places, and western yellow pine in all situations. The work gives promise of good results.

Nebraska.—One hundred acres of land in the sand hills of the Dismal River Forest Reserve, Nebraska, were planted this spring by the Bureau of Forestry—eighty acres in pine seedlings, 100,000 being set out; the other twenty acres were planted with seed. The work will be continued this summer, and the nursery will be enlarged so as to cover two acres. The Bureau intends to increase the size of the nursery gradually, so as to make it grow enough seedling trees every year to furnish sufficient stock for the planting. It is intended to plant the whole of the Niobrara and Dismal River reserves, which are now barren sand hills, to forest. The Dismal River Reserve includes 86,000 acres; the Niobrara Reserve, 126,000. A survey of the boundaries of the Niobrara Reserve will be made this summer.—[Forestry and Irrigation.]